

GROUNDWATER DELINEATION STUDY – REPORT

961328

US EPA RECORDS CENTER REGION 5



501145

NBIA OU1 PRP Group

**North Bronson Industrial Area
Operable Unit 1
Bronson, Michigan**

August 2010




O'BRIEN & GERE
www.obg.com

REPORT
GROUNDWATER DELINEATION STUDY
North Bronson Industrial Area
Operable Unit 1

Bronson, Michigan

Prepared for:

NBIA OU1 PRP Group



SCOTT L. CORMIER, PE, VICE PRESIDENT
O'Brien & Gere Engineers, Inc.

TABLE OF CONTENTS

List of Tables.....	ii
List of Figures.....	ii
List of Appendices.....	ii
List of Abbreviations and Acronyms.....	iii
Professional Engineer Acknowledgement.....	iv
1. Introduction.....	1
1.1 Background.....	1
1.2 Purpose and Objectives.....	2
1.3 Summary of Phase 1 Activities.....	2
2. Phase 2 Groundwater Delineation Activities.....	3
2.1. Monitoring Well Installation and Groundwater Sampling Program.....	3
2.1.1. Soil Boring Drilling Program.....	3
2.1.2. Monitoring Well Installation.....	4
2.1.3. Monitoring Well Development.....	5
2.1.4. Water Level Measurements.....	6
2.1.5. Groundwater Sampling and Analysis.....	6
2.2. Quality Assurance/Quality Control.....	7
2.3. Decontamination Procedures.....	7
2.4. Handling of Investigation-Derived Wastes.....	7
2.5. Sampling Documentation.....	7
2.6. Data Validation, Management, and Evaluation.....	7
2.7. Surveying.....	8
3. Findings.....	9
3.1. Geology.....	9
3.2. GroundWater.....	9
3.3. Field Observations.....	10
3.4. VAP Sample Results.....	10
3.5. GroundWater Sample Results.....	10
3.6. Extent of Chlorinated VOCs, Metals, and Cyanide in Groundwater.....	10
3.6.1. Chlorinated VOCs in Groundwater.....	11
3.6.3. Cyanide in Groundwater.....	12
4. References.....	13

LIST OF TABLES

- 1) Monitoring Well Construction Details
- 2) Groundwater Elevation Data
- 3) Vertical Gradient Data
- 4) VAP Data Summary – VOCs in Groundwater
- 5) Groundwater Monitoring Data Summary

LIST OF FIGURES

- 1) Site Location Map
- 2) Site Layout
- 3) Geologic Cross-Sections
- 4) Groundwater Contour Map – June 7, 2010
- 5) Groundwater Contour Map – October 13, 2008
- 6) Groundwater Contour Map – January 22, 2009
- 7) Extent of Chlorinated VOCs in Groundwater
- 8) Bronson Township Properties with Potentially Affected Groundwater

LIST OF APPENDICES

- | | |
|------------|--|
| Appendix A | Field Notes |
| Appendix B | Boring Logs |
| Appendix C | Groundwater Sampling Logs |
| Appendix D | Monitoring Well Construction Logs |
| Appendix E | Well Development Logs |
| Appendix F | Analytical Laboratory Reports and Chain-of-Custody Forms (CD attached) |
| Appendix G | Data Validation Report |

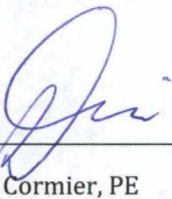
LIST OF ABBREVIATIONS AND ACRONYMS

amsl	Above mean sea level
ASTM	American Society for Testing and Materials
CD #30	County Drain #30
CHA	Branch - Hillsdale - St. Joseph Community Health Agency
ELA	Eastern Lagoon Area
FID	Flame ionization detector
FSQAP	Field Sampling and Quality Assurance Plan
ft-bgs	Feet below the ground surface
GSI	Groundwater to surface water interface
HAS	Hollow-stem auger
IDW	Investigation-derived waste
MDEQ	Michigan Department of Environmental Quality
MDNRE	Michigan Department of Natural Resources and Environment
µg/L	Microgram per liter
ml/min	Milliliter per minute
NBIA	North Bronson Industrial Area
NTU	Nephelometric turbidity unit
OU1	Operable Unit 1
PDI	Pre-Design Investigation
PPE	Personal protective equipment
ppmv	Parts per million by volume
ROD	Record of Decision
RI	Remedial Investigation
TAL	Target analyte list
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
VAP	Vertical aquifer profiling
VOC	Volatile organic compound
WLA	Western Lagoon Area

PROFESSIONAL ENGINEER ACKNOWLEDGEMENT

**North Bronson Industrial Area, Operable Unit No. 1, Bronson, Michigan
Groundwater Delineation Study Report – August 2010**

The undersigned certifies that they have reviewed the attached document. To the best of our knowledge, this report is in material compliance with applicable state, federal, and local regulations. The data presentations contained herein are consistent with O'Brien & Gere standards and generally accepted practices in the environmental profession.

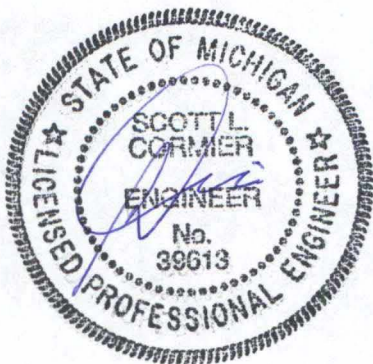


Scott L. Cormier, PE

Vice President

Michigan Professional Engineer No. 6201039613

Date: _____



SEAL

1. INTRODUCTION

The North Bronson Industrial Area (NBIA) Site Operable Unit 1 (OU1) Potentially Responsible Parties Group (Group) retained O'Brien & Gere to conduct a Groundwater Delineation Study for the Western Lagoon Area (WLA) at the NBIA Superfund Site in Bronson, Michigan (Figure 1). The Groundwater Delineation Study was conducted in two phases, with the first phase completed in 2009. The *Preliminary Ground Water Delineation Data Report* (O'Brien & Gere, 2009a) and supplemental letter report (O'Brien & Gere, 2009b) described the data collection activities and results of the first phase of work. This *Groundwater Delineation Study Report* documents the second phase of activities completed in 2010 and presents the results of the most-recent analyses of collected groundwater samples taken from areas west and northwest of the WLA. For completeness, this report discusses the data from both phases of the study. Except as specifically noted in this report, the completed work has been performed in accordance with the methods described in the *Field Sampling Quality Assurance Plan* (FSQAP), as amended, and the approved *Groundwater Delineation Study Work Plan* (O'Brien & Gere, 2008), as amended by the Group's letter to the U.S. Environmental Protection Agency (USEPA) entitled *Completion of Groundwater Delineation Study, Western Lagoon Area North Bronson Industrial Area Site Operable Unit 1, Bronson, Michigan*, dated April 15, 2010. The USEPA approved the amended plan, with clarifications, via its letter of April 29, 2010.

1.1 BACKGROUND

The NBIA Superfund Site (Site) is located in the City of Bronson, Branch County, Michigan. As defined in the Record of Decision (ROD) issued by the Michigan Department of Environmental Quality (MDEQ, now the Michigan Department of Natural Resources and Environment [MDNRE])¹ and USEPA in June 1998, the Site encompasses an area of approximately 220 acres in the northern section of Bronson and is bounded to the east by Lincoln Street, to the north by County Drain #30 (CD #30), to the west by Burr Oak Road, and to the south by Fillmore and Union Streets. Land use in the vicinity of the Site consists of a mixture of industrial, commercial, residential, and agricultural uses. The location of the Site is depicted on Figure 1.

CD #30 is a man-made drainage channel approximately 0 to 6 feet wide and 3 to 6 feet deep built prior to 1930 to provide improved drainage for local agricultural fields. The origin of the drain is a small marsh area approximately ½ mile northeast of the Site from which the ditch flows southwest, west, and then northwest, eventually discharging to Swan Creek approximately 1½ miles northwest of the Site. CD #30 is managed by the Branch County Drain Commission.

OU1 at the NBIA Site addresses those areas and media impacted by constituents originating from the WLA in the northwest portion of the Site and the Eastern Lagoon Area (ELA) located in the northeast portion of the Site. The City of Bronson owned and operated both sets of lagoons, which were built in 1938 and 1949, respectively, to receive wastewater from several industries located in the northern portion of the City. The OU1 remedy also addresses potential exposure to impacted groundwater throughout the Site through implementation of groundwater use restrictions where needed via City ordinance or environmental restrict covenants on parcels in Bronson Township.

In 2004 and 2005, a Site-wide groundwater sampling program and surveys of private wells both in the City of Bronson and Bronson Township were conducted as pre-design investigations (PDI) to supplement studies conducted earlier, including those in the Remedial Investigation (RI) (Warzyn, 1993). In reviewing the results of these investigations, USEPA noted that the limits of impacted groundwater in the direction of the nearest private wells (*i.e.*, west and northwest of the WLA along Burr Oak Road) were not defined by the RI or PDI data. The private wells have been routinely sampled by the county health department and have shown no detectable concentrations of volatile organic compounds (VOCs) or other Site-related constituents.

¹ For simplicity in this report, the acronym MDNRE is used to refer to both the current and predecessor agencies, except in citations to specific guidance documents or reports.

1.2 PURPOSE AND OBJECTIVES

The purpose and objectives of the OU1 Groundwater Delineation Study were the following:

- Delineate the extent of impacted groundwater between the WLA and the nearest potential receptors north, west, and northwest of the WLA;
- Provide baseline (pre-remedial) groundwater monitoring in the WLA in advance of the planned OU1 lagoon consolidation and closure activities; and
- Obtain additional data regarding groundwater flow direction in the vicinity of the WLA.

This report documents the additional Groundwater Delineation Study activities and results of the program of monitoring well installation and development, groundwater sampling, laboratory analysis, and data management. Descriptions of the Site, Site background, geology and hydrogeology, and groundwater flow and quality characteristics were provided in the Work Plan and Phase 1 data report. Further discussion of these topics is provided in this report only to the extent that they pertain to the groundwater investigation activities described herein. This report serves as a basis for developing plans for OU1 post-remedial groundwater monitoring and for identifying properties in Bronson Township for which environmental restrictive covenants may be needed to minimize potential exposure to impacted groundwater.

1.3 SUMMARY OF PHASE 1 ACTIVITIES

The Groundwater Delineation Study was initiated in 2008. As part of this work, Geoprobe® boring and vertical aquifer profile (VAP) sampling were used to identify the locations for eight new monitoring wells (*i.e.*, MW-6D, MW-40, MW-42, MW-43, MW-44S/D, and MW-45S/D). The placement of the well screens was based on the VAP results. In addition, two wells were installed as replacement wells for damaged or missing existing well locations MW-33I and MW-39. Groundwater levels were measured and groundwater samples were collected and analyzed from the newly installed wells and selected previously installed wells. The results of the 2008 activities were summarized in the *Preliminary Ground Water Delineation Data Report* (O'Brien & Gere, 2009a) and a supplemental letter report (O'Brien & Gere, 2009b).

2. PHASE 2 GROUNDWATER DELINEATION ACTIVITIES

The Phase 2 Groundwater Delineation Study activities were implemented to complete the delineation of the groundwater impacts west and northwest of the WLA. Five VAP borings (*i.e.*, GP-21, GP-22, GP-23, GP-24, and GP-25) were installed west of the WLA between Burr Oak Road and just north of CD #30 to address the study objective of delineating groundwater impacts west of the WLA. One additional VAP boring (GP-26) was installed to monitor the interior of the groundwater plume west of the WLA. These borings are located between the WLA and the nearest potential groundwater receptors at residences along Burr Oak Road (Figure 2).

VAP sampling was conducted in these borings to evaluate VOC concentrations in groundwater associated with the variable lithologies throughout the upper aquifer. Based on the VAP results, and in consultation with the MDNRE, groundwater monitoring wells were installed adjacent to five of the six borings (designated MW-41, MW-46, MW-47, MW-48, and MW-49). The VAP borings were abandoned by grouting with bentonite grout immediately after completion.

One existing monitoring well (MW-28) was repaired during the recent work. The well protector and riser casing at MW-28 had been damaged (bent) by farming operations, so the well protector and well casing were cut off below the damage, and a new riser casing and new well protector were installed.

Water levels were gauged in the five newly installed monitoring wells, the eight monitoring wells and two replacement wells installed in 2008, and 26 existing wells/piezometers. Water-level measurements were taken approximately two weeks after completing development of the newly installed wells. Groundwater samples were then collected from the five newly installed monitoring wells, and the eight monitoring wells and two replacement wells installed in 2008 following the water level gauging. Copies of field notes for the Phase 2 Groundwater Delineation Study activities are provided in Appendix A.

2.1. MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING PROGRAM

2.1.1. Soil Boring Drilling Program

Six soil borings (*i.e.*, GP-21, GP-22, GP-23, GP-24, GP-25, and GP-26) were installed to assess groundwater quality for placement of monitoring wells. These soil borings were installed and VAP sampling was conducted using Geoprobe® drilling methods. The boreholes were advanced to the bottom of the upper aquifer, and the till was tagged and identified at each location. A descriptive log of subsurface materials recovered during drilling was maintained in general accordance with the Unified Soil Classification System (USCS), American Society for Testing and Materials (ASTM) Method D2488. Sample descriptions (*e.g.*, color, texture, major and minor components), organic vapor readings, depth to water, and other characteristics were recorded on the boring logs, copies of which are contained in Appendix B.

For Geoprobe® drilling, soil sampling was performed by advancing a 5-foot closed-piston macro core (1-½ inch inside diameter) sampler for continuous sample collection. The closed-piston macro core sampler was advanced to the appropriate depth for the collection of soil samples and then the drive point was released and the sampler advanced into the undisturbed subsurface material. The sampler was then retracted and opened for soil classification. The total ionizable VOC concentration was measured in the soil headspace using an organic vapor analyzer with a flame ionization detector (FID).

The VAP sampling was conducted at approximate 8-foot vertical intervals starting at the base of the upper aquifer (top of till), which was encountered approximately 24 to 37 feet below ground surface (ft-bgs), upward to the water table, typically within the 4- to 8-ft-bgs interval. Adjustments in the 8-foot vertical intervals were made as necessary to account for FID results, interbedded fine-grained zones, thin sandy seams, or changes in the water table observed at individual boring locations. VAP sampling at GP-26 was only conducted at the base of the upper sand unit and a sand seam within otherwise clayey soils beneath the upper sand unit. Originally, no VAP sampling was planned for this location, but with the existence of a sand seam within the underlying clayey soils, samples were collected to determine where to set the well screen. Previous sampling results from nearby VAP borings GP-17 and GPMW-41 in 2008 indicated that VOC concentrations were higher at the base of the upper sand unit.

VAP sampling was conducted at the following screen intervals:

Well ID	Screen Interval (ft-bgs)	Well ID	Screen Interval (ft-bgs)	Well ID	Screen Interval (ft-bgs)
GP-21	3 to 7	GP-22	7 to 11	GP-23	7 to 11
	7 to 11		13 to 17		15 to 19
	15 to 19		21 to 25		20 to 24
	21 to 25				25.5 to 29.5
					32 to 36
GP-24	3 to 7	GP-25	3.5 to 7.5	GP-26	20 to 24
	7 to 11		7.5 to 11.5		27 to 31
	20 to 24		15.5 to 19.5		
			23.5 to 27.5		

VAP samples were collected by advancing a slotted screen sampler (4-foot length of 0.004-inch slot well screen) through the borehole to the base of the aquifer, releasing the screen, and then retracting the sampler to allow the formation to collapse around the screened sampler.

VAP samples were collected using low-flow sampling techniques by attaching a length of new polyethylene tubing to a peristaltic pump and lowering the tubing intake into the screened interval to the approximate midpoint of the screen in accordance with the approved *Groundwater Delineation Study Work Plan* (O'Brien & Gere, 2008). Groundwater samples were collected for laboratory analysis after the field geochemical parameters (*i.e.*, dissolved oxygen, specific conductance, oxidation-reduction potential, pH, temperature, and turbidity) stabilized. If geochemical parameters did not stabilize, a sample was collected after no more than one hour of purging. Copies of the groundwater sampling logs are provided in Appendix C.

VAP samples were analyzed for VOCs by USEPA Method 8260B. The collected VAP samples were submitted to TestAmerica of North Canton, Ohio (TestAmerica) for analysis.

After sampling a defined interval, the screen was retracted to the next higher VAP sampling interval where the process was repeated for the next VAP sample. This process continued to the groundwater table sample interval. Laboratory analyses were performed with expedited turnaround (between 24 and 72 hours).

Soil boring locations were abandoned by filling the hole with bentonite grout immediately after completing the VAP sampling.

2.1.2. Monitoring Well Installation

Based on the VAP sample results, five monitoring wells were installed to complete the Groundwater Delineation Study. Monitoring wells MW-41, MW-46, MW-47, MW-48, and MW-49 were installed adjacent to their corresponding VAP boring locations (Figure 2). Monitoring wells were installed to depths of up to 29.5 ft-bgs, with the vertical placement of monitoring well screens based on the VAP results. Monitoring wells MW-46 and MW-47 were installed at the base of the upper aquifer (top of till), while monitoring wells MW-41 and MW-49 were installed in sands above the top of the till. Monitoring well MW-48 was installed in the middle to upper portion of the aquifer.

The following table summarizes the screen interval selected for each well location:

Boring ID	Well ID	Screen Interval (ft-bgs)
GP-23	MW-41	24.5 to 29.5
GP-22	MW-46	20 to 25
GP-24	MW-47	20 to 24
GP-21	MW-48	9 to 14
GP-26	MW-49	20.8 to 23.8

Table 1 summarizes construction details for these new wells and other wells gauged or sampled in the Groundwater Delineation Study.

The monitoring wells were installed using hollow-stem auger (HSA) drilling methods using 4.25-inch inside-diameter HSAs that were blind drilled adjacent to the Geoprobe® VAP boring locations to the base of the aquifer, or the selected screened zone, if above the base of the aquifer. The monitoring wells were constructed of 2-inch inside-diameter flush-joint polyvinyl chloride riser casing and 5-foot long stainless steel well screens with 0.007-inch slots, except at monitoring well locations MW-47 and MW-49, which utilized 4- and 3-foot long screens, respectively to allow screening of discrete sand seams. The screen and riser assembly was placed through the HSAs to the desired depth. A washed, graded silica sand pack was placed around the well screen and extended no more than three feet above the top of the screen (typically about two feet). The sand pack material was slowly placed to avoid bridging the sand and causing a “sand lock” condition that could have raised the well during installation. A two-foot coarse granular bentonite seal was added to the annular space above the sand pack and allowed to hydrate for at least a half-hour after installation. The bentonite was likewise slowly poured into the borehole to avoid bridging. The remainder of the annular space was grouted using a cement-bentonite grout to within one foot of the ground surface. The HSAs were retracted periodically during well installation to minimize the potential for heaving soils and to avoid sand or bentonite locking during well installation. Well construction details are provided on the logs contained in Appendix D.

2.1.3. Monitoring Well Development

The newly installed monitoring wells were developed after installation of the well screen, casing, and sand pack, and prior to the installation of the annular space seals during well construction to remove fine-grained sediments from the well screen and improve the connection between the well and the aquifer. Well development allows water to flow freely from the aquifer into the well and reduces the turbidity of the water during sampling.

Consistent with the procedures requested by the MDNRE, well development for the newly installed wells was performed by surging of the well with a surge block and then purging water from the well with a monsoon submersible pump. Water was purged until physical parameters stabilized for three consecutive readings. Physical parameters monitored to assess stabilization were temperature (± 0.5 Celsius), specific conductance (± 10 percent), pH (± 0.3 units), dissolved oxygen (± 0.5 milligrams per liter), oxidation-reduction potential (± 5 percent), and turbidity (± 20 percent). Well development continued beyond stabilization to a maximum of four hours if the turbidity of the purge water remained above 20 nephelometric turbidity units (NTUs). Development of each newly installed monitoring well was documented on development logs; copies of these logs are provided in Appendix E.

Well development water was contained in 55-gallon drums that were transported daily to a staging area at the WLA pending final disposal. Each drum was clearly marked with respect to well location(s) from which the development water was generated. Management of investigation-derived waste (IDW) is discussed in Section 2.4.

2.1.4. Water Level Measurements

Synoptic groundwater and surface water level measurements were collected on June 7, 2010 following well installation (*i.e.*, about two weeks after development of the newly installed monitoring wells) and prior to conducting groundwater sampling. These water-level measurements were used to assess groundwater flow conditions across the WLA and to generate a groundwater potentiometric surface map. Water level measurements were collected from the following locations:

- *Newly installed monitoring wells* – MW-41, MW-46, MW-47, MW-48 and MW-49;
- *Monitoring wells installed in 2008* – MW-6D, MW-33I, MW-39, MW-40, MW-42, MW-43, MW-44S, MW-44D, MW-45S, MW-45D;
- *Select existing monitoring wells and piezometers in the vicinity of the WLA* – PZ5, PZ-6S, PZ-6D, PZ-7S, PZ-7D, MW-4S, MW-5S, MW-5D, MW-6S, MW-7S, MW-8S, MW-8D, MW-9S, MW-25, MW-26, MW-27, MW-28, MW-29, MW-30, MW-31, MW-32S, MW-32I, MW-33S, MW-36, MW-37, MW-38, and
- *CD #30 staff gauge* – SG-1R.

Copies of field notes containing the data from well gauging and surface water level measurements are provided in Appendix A.

2.1.5. Groundwater Sampling and Analysis

Groundwater was sampled from the five newly installed wells (*i.e.*, MW-41, MW-46, MW-47, MW-48 and MW-49) and the recently (2008) installed or replaced wells (*i.e.*, MW-6D, MW-33I, MW-39, MW-40, MW-42, MW-43, MW-44S, MW-44D, MW-45S, and MW-45D).

The groundwater sampling took place approximately two weeks after the installation and development of the new monitoring wells to allow for equilibration and stabilization. The monitoring wells were sampled using low-flow techniques in accordance with USEPA procedures (Puls and Barcelona, 1996). A portable bladder pump system with new polyethylene tubing was used to extract groundwater from each monitoring well. Groundwater was purged at a rate between 100 milliliters per minute (ml/min) and 160 ml/min until the water quality parameters stabilize, as measured with a YSI 600xl or equivalent meter utilizing a flow-through cell. A separate Hach® (DR820) meter was utilized for turbidity measurements. Care was taken to minimize the drawdown within the wells during purging in accordance with standard low-flow sampling techniques. The extracted ground water was transferred directly into the appropriate sample containers once water quality parameters stabilized and the tubing connecting the water quality meter had been disconnected. VOC samples were collected first, followed by metals and cyanide samples. Copies of the groundwater sampling logs are provided in Appendix C.

One of the two water quality meters utilized during this round of groundwater sampling recorded elevated pH readings during purging at monitoring wells MW-41, MW-45S, and MW-45D, which appeared to indicate potential grout intrusion issues with these wells. After sampling MW-45S, the meter appeared to be out of calibration, so it was recalibrated, but still showed elevated groundwater pH readings. Subsequently, pH readings were obtained from these wells utilizing the second water quality meter to evaluate the situation, which produced pH readings between 6.97 and 7.29 indicating that the initial meter was in error. The first of the two water quality meters was then taken out of service. Follow up with the equipment rental company indicated that the pH probe for the first meter was malfunctioning, and it was replaced. Therefore, the subsequent pH readings are considered representative for these wells, and it was concluded that grout intrusion is not an issue in the wells.

Well purge water was contained in 55-gallon drums that were transported daily to a staging area at the WLA pending final disposal. Drums were clearly marked by well location. IDW management is discussed in Section 2.4.

The groundwater samples were submitted under routine chain-of-custody protocols to TestAmerica, a National Environmental Laboratory Accreditation Program certified laboratory, for analysis of the following parameters:

- Target Compound List VOCs using USEPA Method 8260B;
- Total analyte list (TAL) metals, except mercury, using USEPA Method 6010B;
- Mercury using USEPA Method 7470A;
- Total cyanide using USEPA Method 9012A; and
- Free (weak acid dissociable) cyanide using Standard Method 4500 (American Water Works Association, *et al.*, 1992).

2.2. QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance and quality control measures implemented during field sampling activities included such activities as field equipment calibration, chain-of-custody protocols and quality control sample collection such as equipment trip blanks, field duplicate samples, and matrix spike/matrix spike duplicate samples in accordance with the Work Plan and Section A.4.1 of the FSQAP.

2.3. DECONTAMINATION PROCEDURES

The field sampling program included decontamination procedures to minimize the potential for contaminants to be introduced into the sample locations or transferred across the study area. Equipment that came into contact with soil or groundwater, underwent an initial cleaning process, was cleaned between sample locations to prevent cross-contamination, and was cleaned prior to leaving the study area at the conclusion of drilling/sampling activities in accordance with the Work Plan and Section A5.3.6 of the FSQAP.

2.4. HANDLING OF INVESTIGATION-DERIVED WASTES

IDW, including soils, decontamination fluids, personal protective equipment (PPE), and disposable sampling supplies resulting from the field activities, was segregated and placed in new, properly labeled U.S. Department of Transportation 17H 55-gallon drums. In accordance with the approved FSQAP, as amended, the IDW drums were staged in the WLA.

Drums of excess soil cuttings and other solids (*e.g.*, PPE) were staged in the WLA for eventual disposition as part of the OU1 source control remedial action. IDW disposal methods will correspond to the methods employed in addressing similar remediation wastes generated during remedial action construction activities. Drums of decontamination liquids, well development water, and purge water will be profiled, manifested, and disposed of off-site in accordance with local, State, and Federal regulations.

2.5. SAMPLING DOCUMENTATION

The collection of samples was documented on sample collection field forms, copies of which are contained in Appendix C. The collection, transfer of custody, and shipping of the samples to the analytical laboratory were documented using chain-of-custody forms contained in Appendix F, along with the analytical reports for the sample events.

2.6. DATA VALIDATION, MANAGEMENT, AND EVALUATION

The groundwater analytical data (except for VAP data) generated during the investigation were validated (100-percent full data validation) according to the procedures described in Section A18.1 of the FSQAP. The purpose of this data assessment was to provide information to determine the uncertainty and bias in the data as considerations for decision-making. Appendix G provides the data validation report. The data are considered useable for its intended purpose. No data were rejected. Qualifiers added in the data validation process are indicated in the presentation in data tables.

Data management procedures were established to effectively process the data generated during the investigation such that the relevant data descriptions (sample numbers, methods, and procedures) are readily accessible and accurately maintained. Data were collected and recorded in a variety of ways during the

sampling program. These included utilizing standard field forms, field notebooks, and laboratory generated data. The original forms and data are maintained in O'Brien & Gere's files. Data amenable to computerization, such as analytical data, were input to a data storage system.

2.7. SURVEYING

The spatial location, and surface and top of casing elevations of the newly installed, recently installed (2008), and existing monitoring wells sampled in this study were surveyed using survey-grade global positioning system techniques by a professional surveyor registered in the State of Michigan so that all of the monitoring wells utilized for this study were surveyed at the same time. Some of the wells have not been resurveyed since 1991, and the new encompassing survey will rule out errors associated with different survey events, which may be important for establishing the groundwater flow characteristics. The locations and elevations of the monitoring wells and VAP boring location were surveyed using the state-plane coordinate system and were converted to the same coordinate system used for other surveys within the NBIA, as necessary, and were incorporated into the existing Site layout map (Figure 2). Two permanent benchmarks were established for the Site during this time also. The locations of the benchmarks are also shown on Figure 2.

3. FINDINGS

The information obtained from the activities described in Section 2 is presented in the following section. Information supporting the observations and findings presented in this report is provided in the table, figures, and appendices of this report.

3.1. GEOLOGY

The geology encountered in the five soil borings installed as part of the additional Groundwater Delineation Study activities generally consisted of the following generalized stratigraphy:

- Silty sand or sandy silt (topsoil) layer with a USCS symbol of SM to ML to depths of up to 1.5 ft-bgs;
- Often underlain by a clayey sand (SC) to depths of up to 4 ft-bgs;
- Between 4 ft-bgs to typically 8 to 11 ft-bgs is a wet, sand with little silt, and trace to little fine gravel (SP to SM);
- Underlain by a sand and gravel (SP-GP) layer to depths of up to about 19 ft-bgs, but more typically to about 11 to 15 ft-bgs;
- Underlain by medium stiff to stiff, sandy, silty clay (CL), or clayey sand (SC) layer from typically about 19 ft-bgs to up to 22 ft-bgs; however, at GP-24 and GP-26 this clayey layer was considerably thicker and was observed from 11 ft-bgs to 20 ft-bgs;
- Underlain by additional layers of interbedded sand (SP) and clay (CL) or clayey sand (SC) layers varying in thickness from a few inches to several feet to depths ranging from about 22 to typically about 27.5 ft-bgs, but to depths of 36.3 ft-bgs and 36.8 ft-bgs at GP-23 and GP-26, respectively;
- Underlain by a non-plastic, stiff to hard silty, sandy clay (or silt) (CL) (or ML) (glacial till) observed to depths of at least 40 ft-bgs. This basal till layer underlies the upper aquifer at the NBIA Site and separates it from the lower aquifer.

The geology observed during the additional Groundwater Delineation Study activities was consistent with the geology observed during the 2008 activities. Geologic cross sections A-A', B-B', and C-C' illustrate the general geology observed during the study (Figure 3). Cross sections A-A' and C-C' illustrate the geology along the western edge of the study area, while cross section B-B' illustrates the geology along CD #30.

The intermediate clay or clayey sand layers, although often described similar to the basal till layer, are discernable from the basal till layer because they are softer and appear to be under-consolidated, whereas the basal till is over-consolidated. This over-consolidation indicates that the basal till layer was over ridden by the glacier and compacted or consolidated (geotechnically, not petrologically) indicating that it was deposited during an earlier episode of glaciation than the intermediate layers. The intermediate layers appear to be associated with the terminal moraine located north of the study area and appear to indicate several processions and regressions of the generally ablating glacier. The interbedded sand seams and the generally thicker upper aquifer south and east of the WLA represent outwash.

3.2. GROUNDWATER

Groundwater was encountered at depths ranging from 3 to 6 ft-bgs during drilling. The most recent round of groundwater levels (*i.e.*, from June 7, 2010) indicates depth to water measurements ranging from about 4 to 13 feet below top of casing, which corresponds to about 2 to 11 ft-bgs. Groundwater elevations range from a high of 905.38 ft above mean sea level (ft-amsl) at MW-4S south of the WLA to 901.59 ft-amsl at MW-48 located northwest of the WLA (Table 2). The water level in CD #30 at staff gage SG-1R was 902.86 ft-amsl. Figure 4 illustrates the groundwater contours for the Site on June 7, 2010, which indicates that groundwater generally flows from the south and southeast toward the north and northwest.

Data collected during the Groundwater Delineation Study (June 2010, January 2009, October 2008) (Figures 4 through 6, which have been adjusted to reflect the new survey data), indicate that CD #30 serves as a discharge

zone for the shallow aquifer. Where intermediate clay/clayey sand layer(s) are present, some of the groundwater may locally underflow CD #30. This underflow subsequently flows in the direction of the drain, discharging into CD #30 further downstream. The capture zone of CD #30 appears to be in close proximity to the drain. Furthermore, it appears the drain tile located in the ditch adjacent to GP-17, GP-18, and MW-40 may be affecting (lowering) the water level in this area.

It appears there is a very slight downward vertical gradient southeast of the WLA; otherwise, the vertical gradients south of CD #30 are neutral, and there are slight to moderate upward vertical gradients in close proximity to CD #30 based on the water level data at nested well locations (Table 3). These water level data confirm that CD #30 receives discharge from the upper aquifer in this area. The vertical gradients and the fact that some of the wells are screened at the base of the aquifer were factored into the construction of Figures 4 through 6. The potentiometric contours shown in these figures were developed based on using professional judgment and are not computer generated.

The three rounds of groundwater elevations collected during the Groundwater Delineation Study indicate that although groundwater elevations changed over time due to changes in precipitation, the general flow directions and characteristics remained relatively consistent over these three sampling events. The gradients were slightly higher (or steeper) during wetter periods and lower (or flatter) during drier periods, but the flow directions remained consistent (Figures 4 through 6). The water levels collected in June 2010 were on average about 0.8 feet higher than the January 2009 water levels and 1.0 foot higher than the October 2008 water levels. The most-recent round of water level measurement show higher levels than the previous rounds because May and June 2010 were wetter than normal, and June or late spring levels tends to be higher than fall (October) and winter (January) levels, even in years with normal late spring rainfall.

3.3. FIELD OBSERVATIONS

No significant olfactory or visual indication of impacts was observed during drilling, VAP sampling, well installation and development, or groundwater sampling.

FID readings on soils during drilling were generally non-detectable; detectable FID readings were only observed at boring locations GP-24 and GP-25 during this round of activities. The FID readings at these boring locations ranged from 0 parts per million by volume (ppmv) to 2.4 ppmv at 9 ft-bgs in the boring for GP-25. VAP groundwater samples were collected in the zones where elevated FID readings were observed.

3.4. VAP SAMPLE RESULTS

Twenty-one VAP groundwater samples were collected from boring locations GP-21 through GP-26 during this round of activities and analyzed for VOCs. The VAP samples were collected to aid in the selection of monitoring well locations and depths of well screens. The analytical results for detected analytes in the VAP groundwater samples are presented in Table 4. The analytical laboratory reports for these samples are contained in Appendix F.

3.5. GROUNDWATER SAMPLE RESULTS

Fifteen monitoring well groundwater samples and two duplicate samples (17 total samples) were collected from selected monitoring wells at the Site. The groundwater monitoring samples were analyzed for VOCs, TAL metals, and cyanide (total and free). The analytical results for detected analytes in the groundwater samples are presented in Table 5. The analytical results for monitoring wells from the first round of Groundwater Delineation Study activities conducted in 2008 are also included in Table 5, so that a side-by-side comparison of analytical results can be made. The analytical laboratory reports for these samples are provided in Appendix F. The data validation report for the 2010 sample data is provided in Appendix G.

3.6. EXTENT OF CHLORINATED VOCs, METALS, AND CYANIDE IN GROUNDWATER

The data from the 2008 and 2010 sampling delineate the extent of both metals and chlorinated VOCs in groundwater west and north of the WLA. These data for chlorinated VOCs, metals, and cyanide are summarized in the following sections.

3.6.1. Chlorinated VOCs in Groundwater

Figure 7 provides a generalized representation of the estimated extent of chlorinated VOCs in groundwater in the WLA and surrounding areas. This figure, which updates similar figures previously provided at the request of USEPA, incorporates the latest results from both rounds of monitoring well sampling conducted as part of the Groundwater Delineation Study. These recent groundwater monitoring data are supplemented by VAP results and historic sampling information. While combining data from different sources and different timeframes introduces some uncertainties, this figure demonstrates that the Groundwater Delineation Study provided the data necessary to achieve the primary objective of defining the limits of impacted groundwater in the shallow aquifer west and northwest of the WLA.

The delineation line in Figure 7 corresponds to the Boundary Criterion for vinyl chloride as specified in the ROD (*i.e.*, 2 µg/L). Near the western limits of impacted groundwater, vinyl chloride is the only chlorinated VOC detected in groundwater. No Boundary Criteria or groundwater to surface water interface (GSI) criteria (MDEQ, 2008) are exceeded beyond this delineation line.

As shown in Figure 7, the extent of chlorinated VOCs in the shallow aquifer above the Boundary Criterion does not encroach on the residential properties west of Burr Oak Road. This interpretation correlates with the results of routine sampling of these wells by the Branch - Hillsdale - St. Joseph Community Health Agency (CHA), including the most-recent sampling in June and July 2010. This CHA sampling has shown no detectable VOCs in the private well samples at the residences at (b) (6) and (b) (6). Similarly, no detectable VOCs were found in any of the 10 private well samples collected by the Branch CHA in June and July 2010 at residences located further to the north and west along Burr Oak Road or side streets. Available well logs show that the private wells at several of these properties are finished in the deeper aquifer. The structure on the property shown as (b) (6) is an abandoned garage with no functioning well.

Figure 8 shows the eight land parcels in Bronson Township potentially affected by impacted groundwater associated with the WLA or ELA. As part of OU1 implementation, the Group will seek Environmental Restrictive Covenants designed to accomplish the following:

- Prohibit use of private wells finished in the upper aquifer (no wells completed in the upper aquifer are known to exist at any of these properties);
- Prohibit future installation of private wells finished in the upper aquifer; and
- Prohibit future installation of wells into the lower aquifer in a manner that could cause cross-contamination of the upper and lower zones.

In accordance with Paragraph 27C of the Consent Decree, these Declarations of Restrictive Covenants will be substantially in the form provided by USEPA as Appendices E and F to the Consent Decree and modified as necessary to make the documents recordable under Michigan law.

3.6.2. Metals in Groundwater

With respect to metals, the evaluation of the groundwater data collected in 2008 and 2010 for the WLA and areas to the north and west is summarized as follows:

- Metals detected in groundwater above established GSI criteria are limited to cadmium and nickel. These metals are primarily found at elevated concentrations above GSI criteria in shallow wells south of CD #30 within or in close proximity to the WLA (*i.e.*, MW-7S, MW-8S, MW-29, MW-30, MW-31, and MW-32I). None of the other metals for which MDEQ established GSI criteria (*i.e.*, arsenic, barium, chromium, copper, lead, silver, or zinc) exceeded GSI criteria in any sample at any well. Silver was not detected above the reporting limit in any sample from any well.
- Metals detected in groundwater above the Boundary Criteria established in the ROD (MDEQ and USEPA, 1998) are also limited to cadmium and nickel. Cadmium and nickel concentrations above Boundary Criteria

are generally limited to wells south of CD #30 within or in close proximity to the WLA. The one possible exception is well MW-42, which is south of CD #30 but west of the WLA, where 126 micrograms per liter ($\mu\text{g/L}$) of nickel were detected in the 2008 sampling. This sample exhibited the highest final turbidity (107.9 NTUs) of all of the samples collected in 2008, and the reported nickel level may have been the result of suspended particulate in the samples. The nickel concentration at MW-42 decreased to 14.5 $\mu\text{g/L}$ in the 2010 sampling event (sample turbidity = 37 NTUs). The ROD-specified Boundary Criterion is 100 $\mu\text{g/L}$.

In addition, concentrations of other metals detected in groundwater were compared to Michigan residential health-based drinking water standards (MDEQ RRD Operational Memorandum No. 1). These comparisons were made to ensure that other metals were not present in groundwater above health-based standard beyond the extent of impacts defined by the chlorinated VOCs (Section 3.6.1). As indicated in the data presented in Table 4, manganese, selenium, thallium, and vanadium concentrations occasionally exceeded health-based standards. These exceedances were generally low-level and sporadic, and most commonly observed within or in close proximity to the WLA in groundwater samples showing impacts from Site-related constituents above established cleanup goals.

Arsenic was detected in groundwater samples at concentrations above Michigan residential health-based drinking water standard (10 $\mu\text{g/L}$) at several wells, including wells outside the WLA, but these concentrations do not show a consistent spatial or temporal pattern. For example, the highest arsenic concentration observed in any sample was 150 $\mu\text{g/L}$ of arsenic at MW-37 during the 2008 sampling. MW-37 is located approximately 900 feet northwest of the WLA and showed no detections of chlorinated VOCs or other Site-related constituents in that 2008 sampling (Figure 7). The elevated arsenic in MW-37 may be related to naturally occurring arsenic entrained in the sample as evident by elevated turbidity in this well during sampling. MW-37 had the second highest final turbidity of the wells sampled in 2008 and/or 2010 (59 NTUs), and had the highest arsenic concentration; similarly, MW-42 had the highest final turbidity (107.9 NTUs), and had the second highest arsenic concentration of 83 $\mu\text{g/L}$.

3.6.3. Cyanide in Groundwater

Total cyanide was not detected in any groundwater sample above the Boundary Criterion of 200 $\mu\text{g/L}$. Free cyanide (conservatively analyzed as weak dissociable cyanide) was not detected in any groundwater sample above reporting limits.

4. REFERENCES

- ASTM. *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*, Method D2488-00. American Society for Testing and Materials, West Conshohocken, PA.
- American Water Works Association, American Public Health Association, and Water Environment Federation. 1992. *Standard Methods for the Examination of Water and Wastewater*, 18th Edition. Washington D.C.
- MDEQ. 2006. "RRD Operational Memorandum No. 1." Remediation and Redevelopment Division, Lansing, Michigan. January 23.
- MDEQ. 2008. "Venting Groundwater Mixing Zone Review - Revised." MDEQ Memorandum, September 16, 2008.
- MDEQ and USEPA. 1998. "Declaration, Selected Remedial Alternative for the North Bronson Industrial Site, Operable Unit 1, City of Bronson, Branch County, Michigan." ("Record of Decision" [ROD]).
- NBIA OU1 Group. 2010. *Completion of Groundwater Delineation Study, Western Lagoon Area North Bronson Industrial Area Site Operable Unit 1, Bronson, Michigan*. Letter from Leo M. Brausch, Project Coordinator, to James J. Hahnenberg, USEPA Remedial Project Manager. April 15, 2010.
- O'Brien & Gere Engineers, Inc. 2006a. *Field Sampling and Quality Assurance Plan, Revision 2, Addendum 1. North Bronson Industrial Area. Operable Unit 1*. February 9, 2006.
- O'Brien & Gere Engineers, Inc. 2006b. *Field Sampling and Quality Assurance Plan, Revision 2, Addendum 2. North Bronson Industrial Area. Operable Unit 1*. July 2006.
- O'Brien & Gere Engineers, Inc. 2006c. *Field Sampling and Quality Assurance Plan, Revision 2, Addendum 3. North Bronson Industrial Area. Operable Unit 1*. August 24, 2006.
- O'Brien & Gere Engineers, Inc. 2008. *Ground Water Delineation Work Plan. North Bronson Industrial Area. Operable Unit 1*. February 2008.
- O'Brien & Gere Engineers, Inc. 2009a. *Preliminary Ground Water Delineation Data Report. North Bronson Industrial Area. Operable Unit 1*. January 2009.
- O'Brien & Gere Engineers, Inc. 2009b. *Second Quarter Letter Report Ground Water Delineation Study. North Bronson Industrial Area*. March 31, 2009.
- R.W. Puls and M.J. Barcelona. "Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures." *EPA Groundwater Issue*. EPA/540/S-95/504. April 1996.
- USEPA. 1996. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, SW-846, 3rd Edition. Washington D.C.
- USEPA. 2010. *Approval of Groundwater Delineation Study, Western Lagoon Area North Bronson Industrial Area Site Operable Unit 1, Bronson, Michigan*. Letter from James J. Hahnenberg, USEPA Remedial Project Manager, to Leo M. Brausch, NBIA OU1 Project Coordinator. April 29, 2010.
- Warzyn, Inc., 1993. *Remedial Investigation, North Bronson Industrial Area, Bronson, Michigan*. Prepared for the Michigan Department of Natural Resources, Lansing, Michigan. Four volumes. July.

TABLES

Table 1
NBIA Operable Unit 1 Groundwater Delineation Study
Monitoring Well Construction Details

Monitoring Location	Date Installed	Coordinates (ft)		Elevation (ft-amsl)		Stickup (ft)	Well Diameter (inches)	Screen Length (ft)	Screen Slot Size (inches)	Well Screen/Riser Material(s)	Top of Screen Depth (ft)	Bottom of Screen Depth (ft)	Elevation (ft-amsl)	
		Northing	Easting	Top of Casing	Ground Surface Elevation								Top of Screen	Bottom of screen
MW-4S	8/5/1989	138062.85	12896726.90	913.27	910.89	2.38	2.00	5	0.01	SCH 40 PVC	6.8	11.8	904.1	899.1
MW-5D	8/5/1989	139115.83	12896510.56	911.71	909.49	2.22	2.00	5	0.01	SCH 40 PVC	41.1	46.1	868.4	863.4
MW-5S	8/5/1989	139122.78	12896510.47	911.68	909.33	2.35	2.00	5	0.01	SCH 40 PVC	7.0	12.0	902.3	897.3
MW-6D	9/23/2008	139906.46	12896013.03	909.19	906.64	2.55	2.00	5	0.007	SS/SCH 40 PVC	23.2	28.2	883.4	878.4
MW-6S	8/8/1989	139906.24	12896017.91	909.26	906.73	2.53	2.00	5	0.01	SCH 40 PVC	7.6	12.6	899.1	894.1
MW-7S	8/3/1989	139856.76	12896302.87	912.55	910.27	2.28	2.00	5	0.01	SCH 40 PVC	8.0	13.0	902.3	897.3
MW-8D	8/3/1989	139866.92	12895901.74	909.52	906.81	2.71	2.00	5	0.01	SCH 40 PVC	22.0	27.0	884.8	879.8
MW-8S	8/6/1989	139862.06	12895899.66	909.55	907.21	2.34	2.00	5	0.01	SCH 40 PVC	6.4	11.4	900.8	895.8
MW-9S	8/6/1989	139628.77	12896576.91	910.59	907.90	2.69	2.00	5	0.01	SCH 40 PVC	5.7	10.7	902.2	897.2
MW-25	11/21/1991	139823.16	12897259.61	910.39	907.70	2.69	2.00	5	0.006	SS	12.0	17.0	895.7	890.7
MW-26	11/26/1991	139607.92	12896170.22	910.66	908.53	2.13	2.00	5	0.006	SS	10.0	15.0	898.5	893.5
MW-27	11/25/1991	139256.30	12895889.63	912.31	909.36	2.95	2.00	5	0.006	SS	44.0	49.0	865.4	860.4
MW-28	11/26/1991	139996.54	12895545.40	909.81	906.63	3.18	2.00	5	0.006	SS	10.0	15.0	896.6	891.6
MW-29	11/27/1991	139824.53	12896497.13	908.99	906.55	2.44	2.00	3	0.006	SS	3.5	6.5	903.1	900.1
MW-30	2/28/2001	139603.85	12895982.61	910.30	907.89	2.41	2.00	10	0.010	SCH 40 PVC	3.0	13.0	904.9	894.9
MW-31	3/2/2001	139764.19	12895856.79	908.03	905.86	2.17	2.00	6	0.010	SCH 40 PVC	2.5	8.5	903.4	897.4
MW-32I	2/27/2001	139848.10	12896190.22	909.98	907.24	2.74	2.00	3	0.010	SCH 40 PVC	9.0	12.0	898.2	895.2
MW-32S	2/27/2001	139846.43	12896196.02	909.85	907.29	2.56	2.00	5	0.010	SCH 40 PVC	3.0	8.0	904.3	899.3
New MW-33I	9/24/2008	139905.73	12896189.65	909.48	906.63	2.85	2.00	5	0.010	SCH 40 PVC	10.3	15.3	896.3	891.3
MW-33S	3/5/2001	139905.13	12896198.09	909.39	907.04	2.35	2.00	5	0.010	SCH 40 PVC	3.0	8.0	904.0	899.0
MW-36	8/1/2002	139790.88	12896187.23	908.66	905.95	2.71	2.00	5	N/A	N/A	~19.0	~24.0	887.0	882.0
MW-37	8/1/2002	140373.51	12895864.61	916.81	914.30	2.51	2.00	5	N/A	N/A	~25.3	~30.3	889.0	884.0
MW-38	8/1/2002	140930.20	12895263.73	912.68	910.13	2.55	2.00	5	N/A	N/A	~26.5	~31.5	883.6	878.6
New MW-39	9/25/2008	140121.67	12895313.49	909.29	906.50	2.79	2.00	5	0.007	SS/SCH 40 PVC	13.0	18.0	893.5	888.5
MW-40	9/24/2008	139980.67	12895199.02	909.37	906.69	2.68	2.00	5	0.007	SS/SCH 40 PVC	20.0	25.0	886.7	881.7
MW-41	5/12/2010	139662.78	12894934.36	908.16	908.46	-0.30	2.00	5	0.007	SS/SCH 40 PVC	24.5	29.5	884.0	879.0
MW-42	9/25/2008	140286.06	12895045.67	908.88	908.43	0.45	2.00	5	0.007	SS/SCH 40 PVC	18.0	23.0	890.4	885.4
MW-43	9/24/2008	140037.79	12895540.77	909.28	905.79	3.49	2.00	5	0.007	SS/SCH 40 PVC	13.8	18.8	892.0	887.0
MW-44D	9/23/2008	139903.34	12896308.17	909.37	906.70	2.67	2.00	5	0.007	SS/SCH 40 PVC	19.8	24.8	886.9	881.9
MW-44S	9/23/2008	139903.60	12896313.61	909.62	906.40	3.22	2.00	5	0.007	SS/SCH 40 PVC	4.5	9.5	901.9	896.9
MW-45D	9/23/2008	139937.48	12895797.30	909.77	906.85	2.92	2.00	5	0.007	SS/SCH 40 PVC	19.5	24.5	887.4	882.4
MW-45S	9/24/2008	139936.01	12895803.63	909.95	906.96	2.99	2.00	5	0.007	SS/SCH 40 PVC	13.0	18.0	894.0	889.0
MW-46	5/13/2010	139851.76	12894748.82	908.57	908.86	-0.29	2.00	5	0.007	SS/SCH 40 PVC	20.0	25.0	888.9	883.9
MW-47	5/11/2010	139892.58	12894954.59	908.75	905.54	3.21	2.00	4	0.007	SS/SCH 40 PVC	19.7	23.7	885.8	881.8
MW-48	5/13/2010	140304.25	12895071.64	907.65	905.07	2.58	2.00	5	0.007	SS/SCH 40 PVC	9.0	14.0	896.1	891.1
MW-49	5/17/2010	139755.99	12895178.98	907.85	904.90	2.95	2.00	3	0.007	SS/SCH 40 PVC	20.7	23.7	884.2	881.2
PZ-5	11/22/1991	139467.53	12897030.27	910.71	907.78	2.93	1.00	3	0.006	SCH 80 PVC	9.0	12.0	898.8	895.8
PZ-6D	11/22/1991	139188.90	12897077.20	909.07	909.24	-0.17	1.00	3	0.006	SCH 80 PVC	57.5	60.5	851.7	848.7
PZ-6S	11/22/1991	139189.11	12897077.18	909.13	909.24	-0.11	1.00	3	0.006	SCH 80 PVC	9.0	12.0	900.2	897.2
PZ-7D	11/25/1991	139377.88	12895891.19	911.64	909.53	2.11	1.00	3	0.006	SCH 80 PVC	38.0	41.0	871.5	868.5
PZ-7S	11/25/1991	139378.06	12895891.40	911.72	909.53	2.19	1.00	3	0.006	SCH 80 PVC	9.0	12.0	900.5	897.5
SG-1R	3/6/2001	139871.21	12896228.17	908.03	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SG-2R	3/6/2001	139954.71	12898157.60	904.14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SG-3	N/A	138932.68	12896354.15	904.48	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SG-4	N/A	139013.21	12896559.96	904.57	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BM1 (West)	7/1/2010	139620.84	12895214.49	905.88	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BM2 (East)	7/1/2010	139614.47	12896512.88	907.82	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

1. N/A = Not Available or Not Applicable
2. SCH 40 PVC = Schedule 40 Polyvinyl Chloride
3. SS = Stainless Steel
4. SCH 80 PVC = Schedule 80 Polyvinyl Chloride
5. ~ = Indicates values is approximate, based on best available data (total depth of well measurement, minus stick up height for bottom of screen).
6. Benchmarks BM1 and BM2 were installed on June 30, 2010 to establish a new consistent survey datum for OU1 monitoring wells. The monitoring wells, with the exception of MW-4S, were resurveyed to the new datum. The elevations for MW-4S and the staff gages were adjusted by subtracting 0.47 ft (average difference between old and new datums) from their old elevations.

Table 2
NBIA Operable Unit 1 Groundwater Delineation Study
Groundwater Elevation Data

Monitoring Location	Depth to Water 10/13/08 (ft bTOC)	Depth to Water 1/22/09 (ft bTOC)	Depth to Water 6/7/10 (ft bTOC)	Elevation (ft-amsl)			
				Top of Casing	Groundwater Elevation 10/13/08	Groundwater Elevation 1/22/09	Groundwater Elevation 6/7/10
MW-4S	9.17	8.81	7.89	913.27	904.10	904.46	905.38
MW-5D	8.50	8.15	7.24	911.71	903.21	903.56	904.47
MW-5S	8.47	8.12	7.22	911.68	903.21	903.56	904.46
MW-6D	6.48	6.34	5.48	909.19	902.71	902.85	903.71
MW-6S	7.21	7.25	6.64	909.26	902.05	902.01	902.62
MW-7S	10.36	10.42	9.69	912.55	902.19	902.13	902.86
MW-8D	6.95	6.79	5.95	909.52	902.57	902.73	903.57
MW-8S	7.70	7.70	7.09	909.55	901.85	901.85	902.46
MW-9S	7.46	7.15	6.30	910.59	903.13	903.44	904.29
MW-25	N/A	7.57	6.90	910.39	N/A	902.82	903.49
MW-26	7.51	7.17	6.23	910.66	903.15	903.49	904.43
MW-27	9.00	8.61	7.54	912.31	903.31	903.70	904.77
New MW-28	7.75	7.77	7.50	909.81	901.59	901.57	902.31
MW-29	6.45	6.40	5.69	908.99	902.54	902.59	903.30
MW-30	7.26	6.92	5.97	910.30	903.04	903.38	904.33
MW-31	5.71	5.70	4.89	908.03	902.32	902.33	903.14
MW-32I	7.81	7.82	7.16	909.98	902.17	902.16	902.82
MW-32S	7.71	7.68	7.02	909.85	902.14	902.17	902.83
New MW-33I	7.34	7.39	6.77	909.48	902.14	902.09	902.71
MW-33S	7.29	7.34	6.72	909.39	902.10	902.05	902.67
MW-36	5.76	5.49	4.65	908.66	902.90	903.17	904.01
MW-37	14.19	14.00	12.73	916.81	902.62	902.81	904.08
MW-38	11.89	11.78	10.35	912.68	900.79	900.90	902.33
New MW-39	7.93	7.94	7.30	909.29	901.36	901.35	901.99
MW-40	7.94	7.91	7.11	909.37	901.43	901.46	902.26
MW-41	N/A	N/A	4.55	908.16	N/A	N/A	903.61
MW-42	7.95	8.01	7.08	908.88	900.93	900.87	901.80
MW-43	6.51	6.54	5.95	909.28	902.77	902.74	903.33
MW-44D	6.43	6.21	5.34	909.37	902.94	903.16	904.03
MW-44S	7.43	7.49	6.90	909.62	902.19	902.13	902.72
MW-45D	7.56	7.51	6.74	909.77	902.21	902.26	903.03
MW-45S	8.03	8.06	7.40	909.95	901.92	901.89	902.55
MW-46	N/A	N/A	5.68	908.57	N/A	N/A	902.89
MW-47	N/A	N/A	6.17	908.75	N/A	N/A	902.58
MW-48	N/A	N/A	6.06	907.65	N/A	N/A	901.59
MW-49	N/A	N/A	3.90	907.85	N/A	N/A	903.95
PZ-5	7.43	7.11	6.23	910.71	903.28	903.60	904.48
PZ-6D	N/A	N/A	4.26	909.07	N/A	N/A	904.81
PZ-6S	N/A	N/A	4.25	909.13	N/A	N/A	904.88
PZ-7D	8.35	7.95	6.89	911.64	903.29	903.69	904.75
PZ-7S	8.44	8.05	6.99	911.72	903.28	903.67	904.73
SG-1R	N/A	N/A	1.60	908.03	902.32	902.51	902.86
SG-2R	N/A	N/A	N/A	904.14	N/A	N/A	N/A
SG-3	N/A	N/A	N/A	904.48	903.14	N/A	N/A
SG-4	N/A	N/A	N/A	904.57	903.03	N/A	N/A
BM1 (West)	N/A	N/A	N/A	905.88	N/A	N/A	N/A
BM2 (East)	N/A	N/A	N/A	907.82	N/A	N/A	N/A

Notes:

1. N/A = Not Available or Not Applicable
2. Benchmarks BM1 and BM2 were installed on June 30, 2010 to establish a new consistent survey datum for OU1 monitoring wells. The monitoring wells, with the exception of MW-4S, were resurveyed to the new datum. The elevations for MW-4S and the staff gages were adjusted by subtracting 0.47 ft (average difference between old and new datums) from their old elevations.

Table 3
NBIA Operable Unit 1 Groundwater Delineation Study
Vertical Gradient Data

Monitoring Location	TOC Elevation (ft amsl)	Screen Length (ft)	Top of Screen Depth (ft bTOC)	Top of Screen Elevation (ft amsl)	Bottom of Screen Depth (ft bTOC)	Bottom of Screen Elevation (ft amsl)	Midpoint of Screen Elevation (ft amsl)	Difference in Screen Midpoint Elevations (ft)	Ground Water Elevation (ft aMSL) 6/7/10	Difference in Groundwater Elevations (ft)	Vertical Gradient
MW-5D	911.71	5.40	42.90	868.81	48.30	863.41	866.11	34.07	904.47	-0.01	-0.0003
MW-5S	911.68	5.40	8.80	902.88	14.20	897.48	900.18		904.46		
MW-6D	909.19	5.00	25.67	883.52	30.67	878.52	881.02	15.94	903.71	-1.09	-0.0684
MW-6S	909.26	5.40	9.60	899.66	15.00	894.26	896.96		902.62		
MW-8D	909.52	5.40	23.80	885.72	29.20	880.32	883.02	15.33	903.57	-1.11	-0.0724
MW-8S	909.55	5.40	8.50	901.05	13.90	895.65	898.35		902.46		
MW-32I	909.98	3.00	11.40	898.58	14.44	895.54	897.06	4.98	902.82	0.01	0.0020
MW-32S	909.85	5.00	5.30	904.55	10.33	899.52	902.04		902.83		
New MW-33I	909.48	5.00	13.00	896.48	18.00	891.48	893.98	7.69	902.71	-0.04	-0.0052
MW-33S	909.39	5.00	5.20	904.19	10.23	899.16	901.68		902.67		
MW-44D	909.37	5.00	22.50	886.87	27.50	881.87	884.37	15.15	904.03	-1.31	-0.0865
MW-44S	909.62	5.00	7.60	902.02	12.60	897.02	899.52		902.72		
MW-45D	909.77	5.00	22.10	887.67	27.10	882.67	885.17	6.20	903.03	-0.48	-0.0774
MW-45S	909.95	5.00	16.08	893.87	21.08	888.87	891.37		902.55		
PZ-6D	909.07	2.95	56.66	852.41	59.61	849.46	850.94	47.96	904.81	0.07	0.0015
PZ-6S	909.13	2.95	8.76	900.37	11.71	897.42	898.90		904.88		
PZ-7D	911.64	2.95	40.37	871.27	43.37	868.27	869.77	28.97	904.75	-0.02	-0.0007
PZ-7S	911.72	2.95	11.48	900.24	14.48	897.24	898.74		904.73		

Notes:

1. N/A = Not Available or Not Applicable
2. TOC = top of casing
3. ft amsl = feet above mean sea level
4. ft = feet
5. ft bTOC = feet below top of casing
6. A negative vertical gradient indicates an upward gradient.

Table 3 (continued)
NBIA Operable Unit 1 Groundwater Delineation Study
Vertical Gradient Data

Monitoring Location	TOC Elevation (ft amsl)	Screen Length (ft)	Top of Screen Depth (ft bTOC)	Top of Screen Elevation (ft amsl)	Bottom of Screen Depth (ft bTOC)	Bottom of Screen Elevation (ft amsl)	Midpoint of Screen Elevation (ft amsl)	Difference in Screen Midpoint Elevations (ft)	Ground Water Elevation (ft aMSL) 10/13/08	Difference in Groundwater Elevations (ft)	Vertical Gradient
MW-5D	911.71	5.40	42.90	868.81	48.30	863.41	866.11	34.07	903.21	0.00	0.0000
MW-5S	911.68	5.40	8.80	902.88	14.20	897.48	900.18		903.21		
MW-6D	909.19	5.00	25.67	883.52	30.67	878.52	881.02	15.94	902.71	-0.66	-0.0414
MW-6S	909.26	5.40	9.60	899.66	15.00	894.26	896.96		902.05		
MW-8D	909.52	5.40	23.80	885.72	29.20	880.32	883.02	15.33	902.57	-0.72	-0.0470
MW-8S	909.55	5.40	8.50	901.05	13.90	895.65	898.35		901.85		
MW-32I	909.98	3.00	11.40	898.58	14.44	895.54	897.06	4.98	902.17	-0.03	-0.0060
MW-32S	909.85	5.00	5.30	904.55	10.33	899.52	902.04		902.14		
New MW-33I	909.48	5.00	13.00	896.48	18.00	891.48	893.98	7.69	902.14	-0.04	-0.0052
MW-33S	909.39	5.00	5.20	904.19	10.23	899.16	901.68		902.10		
MW-44D	909.37	5.00	22.50	886.87	27.50	881.87	884.37	15.15	902.94	-0.75	-0.0495
MW-44S	909.62	5.00	7.60	902.02	12.60	897.02	899.52		902.19		
MW-45D	909.77	5.00	22.10	887.67	27.10	882.67	885.17	6.20	902.21	-0.29	-0.0468
MW-45S	909.95	5.00	16.08	893.87	21.08	888.87	891.37		901.92		
PZ-6D	909.07	2.95	56.66	852.41	59.61	849.46	850.94	N/A	N/A	N/A	N/A
PZ-6S	909.13	2.95	8.76	900.37	11.71	897.42	898.90		N/A		
PZ-7D	911.64	2.95	40.37	871.27	43.37	868.27	869.77	28.97	903.29	-0.01	-0.0003
PZ-7S	911.72	2.95	11.48	900.24	14.48	897.24	898.74		903.28		

Notes:

1. N/A = Not Available or Not Applicable
2. TOC = top of casing
3. ft amsl = feet above mean sea level
4. ft = feet
5. ft bTOC = feet below top of casing
6. A negative vertical gradient indicates an upward gradient.

Table 3 (continued)
NBIA Operable Unit 1 Groundwater Delineation Study
Vertical Gradient Data

Monitoring Location	TOC Elevation (ft amsl)	Screen Length (ft)	Top of Screen Depth (ft bTOC)	Top of Screen Elevation (ft amsl)	Bottom of Screen Depth (ft bTOC)	Bottom of Screen Elevation (ft amsl)	Midpoint of Screen Elevation (ft amsl)	Difference in Screen Midpoint Elevations (ft)	Ground Water Elevation (ft aMSL) 1/22/09	Difference in Groundwater Elevations (ft)	Vertical Gradient
MW-5D	911.71	5.40	42.90	868.81	48.30	863.41	866.11	34.07	903.56	0.00	0.0000
MW-5S	911.68	5.40	8.80	902.88	14.20	897.48	900.18		903.56		
MW-6D	909.19	5.00	25.67	883.52	30.67	878.52	881.02	15.94	902.85	-0.84	-0.0527
MW-6S	909.26	5.40	9.60	899.66	15.00	894.26	896.96		902.01		
MW-8D	909.52	5.40	23.80	885.72	29.20	880.32	883.02	15.33	902.73	-0.88	-0.0574
MW-8S	909.55	5.40	8.50	901.05	13.90	895.65	898.35		901.85		
MW-32I	909.98	3.00	11.40	898.58	14.44	895.54	897.06	4.98	902.16	0.01	0.0020
MW-32S	909.85	5.00	5.30	904.55	10.33	899.52	902.04		902.17		
New MW-33I	909.48	5.00	13.00	896.48	18.00	891.48	893.98	7.69	902.09	-0.04	-0.0052
MW-33S	909.39	5.00	5.20	904.19	10.23	899.16	901.68		902.05		
MW-44D	909.37	5.00	22.50	886.87	27.50	881.87	884.37	15.15	903.16	-1.03	-0.0680
MW-44S	909.62	5.00	7.60	902.02	12.60	897.02	899.52		902.13		
MW-45D	909.77	5.00	22.10	887.67	27.10	882.67	885.17	6.20	902.26	-0.37	-0.0597
MW-45S	909.95	5.00	16.08	893.87	21.08	888.87	891.37		901.89		
PZ-6D	909.07	2.95	56.66	852.41	59.61	849.46	850.94	N/A	N/A	N/A	N/A
PZ-6S	909.13	2.95	8.76	900.37	11.71	897.42	898.90		N/A		
PZ-7D	911.64	2.95	40.37	871.27	43.37	868.27	869.77	28.97	903.69	-0.02	-0.0007
PZ-7S	911.72	2.95	11.48	900.24	14.48	897.24	898.74		903.67		

Notes:

1. N/A = Not Available or Not Applicable
2. TOC = top of casing
3. ft amsl = feet above mean sea level
4. ft = feet
5. ft bTOC = feet below top of casing
6. A negative vertical gradient indicates an upward gradient.

Table 4
NBIA Operable Unit 1 Groundwater Delineation Study
VAP Data Summary - VOCs in Groundwater

Constituent	Concentration (µg/L) by Boring Location and Depth (ft-bgs)											
	GP-21				GP-22			GP-23				
	3 to 7	7 to 11	15 to 19	21 to 25	7 to 11	13 to 17	21 to 25	7 to 11	15 to 19	20 to 24	25.5 to 29.5	32 to 36
Acetone	25 U	25 U	25 U	2.4 J	2.9 J	1.3 J	25 U	1.1 J	25 U	25 U	25 U	25 U
2-Butanone	25 U	25 U	25 U	25 U	0.79 J	25 U	25 U	0.63 J	25 U	25 U	25 U	25 U
Cyclohexane	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethylene	0.25 J	1.7	1.8	0.42 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethylene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethylene (total)	2.0 U	1.7 J	1.8 J	0.42 J	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Methylcyclohexane	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Toluene	1.0 U	1.0 U	0.28 J	0.55 J	0.31 J	0.41 J	0.24 J	0.22 J	1.0 U	0.24 J	0.19 J	0.18 J
Trichloroethylene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl chloride	1.0 U	2.5	1.3	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.9	1.8	1.0 U
Xylenes (total)	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Constituent	GP-24			GP-25				GP-26				
	3 to 7	7 to 11	20 to 24	3.5 to 7.5	7.5 to 11.5	15.5 to 19.5	23.5 to 27.5	20 to 24	27 to 31			
Acetone	25 U	2.3 J	25 U	25 U	25 U	25 U	25 U	25 U	25 U			
2-Butanone	25 U	0.67 J	25 U	25 U	25 U	25 U	25 U	25 U	25 U			
Cyclohexane	1.0 U	1.0 U	1.0 U	1.0 U	0.60 J	0.60 J	0.57 J	1.0 U	1.0 U			
cis-1,2-Dichloroethylene	1.0 U	1.0 U	1.0 U	8.3	7.9	9.4	1.0 U	1.0 U	1.0 U			
trans-1,2-Dichloroethylene	1.0 U	1.0 U	1.0 U	0.49 J	1.0 U	0.28 J	1.0 U	1.0 U	1.0 U			
1,2-Dichloroethylene (total)	2.0 U	2.0 U	2.0 U	8.8	7.9	9.7	2.0 U	2.0 U	2.0 U			
Methylcyclohexane	1.0 U	1.0 U	1.0 U	1.0 U	0.58 J,B	0.59 J,B	0.60 J,B	1.0 U	1.0 U			
Toluene	1.0 U	0.29 J	0.55 J	0.17 J	1.0 U	0.24 J	0.24 J	0.23 J	0.18 J			
Trichloroethylene	1.0 U	1.0 U	1.0 U	0.66 J	0.56 J	1.0 U	1.0 U	1.0 U	1.0 U			
Vinyl chloride	1.0 U	1.0 U	2.8	0.91 J	5.5	10	1.0 U	6.1	0.91 J			
Xylenes (total)	2.0 U	2.0 U	0.31 J	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U			

See notes at end of table.

Table 4
NBIA Operable Unit 1 Groundwater Delineation Study
VAP Data Summary - VOCs in Groundwater

Notes:

1. For VAP sampling locations, see Figure 2.
2. Only constituents detected in one or more groundwater samples are listed in this table.
See Appendix E for analytical reports and complete analytical results.
3. All concentrations reported in units of micrograms per liter ($\mu\text{g/L}$).
4. Data were collected for characterization only and have not been independently validated.
5. Organic Data Qualifiers:
 - U - Constituent not detected at indicated Reporting Limit (RL)
 - J - Estimated concentration detected above minimum detection limit (MDL), but below RL.
 - B - Constituent detected in method blank at a reportable concentration.
6. For clarity, all detections are shown in **bold-face** type.

Table 5
NBIA Operable Unit 1 Groundwater Delineation Study
Groundwater Monitoring Data Summary

Constituent	Groundwater Cleanup Goal (µg/L)		Constituent Concentration (µg/L)							
	Boundary Criterion	GSI Criterion	MW-6D (DUP)			MW-6S	MW-7S (DUP-2)		MW-8D	MW-8S
			2008	2010	2010	2008	2008	2008	2008	2008
Metals										
Aluminum	--	--	1,330	372	430	97 U	97 U	97 U	97 U	97 U
Antimony	6.0 (C)	260 (D)	10 U	10.0 U	10.0 U	1.8 U	10 U	10 U	10 U	1.8 U
Arsenic	10 (A)	160	5.0 J	5.8 J	3.3 J	3.2 U	10.0 U	10.0 U	17.4	5.9 J
Barium	2,000 (A)	1,300	87.3 J	69.5 J	71.7 J	69 J	28.7 J	27.4 J	100 U	100 U
Cadmium	5.0	10	0.66 U	2.0 U	2.0 U	0.66 U	6.2	6.4	0.66 U	0.66 U
Calcium	--	--	99,200	100,000	104,000	76,000	95,900	98,600	96,700	101,000
Chromium	11 (B)	12 (B)	5.3	5.0 U	2.5 J	2.2 U	5.5	5.9	2.2 U	5 U
Cobalt	--	--	7.0 U	7.0 U	7.0 U	7.0 U	7.0 U	7.0 U	1.7 U	1.7 U
Copper	1,400 (C)	32	4.5 U	25.0 U	25.0 U	8.1 J	4.5 U	4.5 U	4.5 U	4.5 U
Iron	--	--	3,220	1,620	1,760	81 U	3,280	3,240	2,620	482
Lead	4.0	140	1.9 U	3.0 U	3.0 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U
Magnesium	--	--	26,600	26,900	27,700	16,900	21,600	22,100	24,900	22,800
Manganese	860 (C)	10,000 (D)	129	68.6	75.8	432	139	141	111	271
Nickel	100	140	25 U	4.8 J	4.6 J	19.9 J	193	198	3.2 U	404
Potassium	--	--	2,500	2,000	2,060	2,740	6,720	6,890	2,340	2,810
Selenium	50 (A)	5.4 (D)	4.1 U	5.0 U	5.0 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U
Sodium	--	--	30,900	29,800	30,200	4,450	21,400	21,800	32,500	16,000
Thallium	2.0 (A)	7.7 (D)	4.7 U	10.0	8.6 J	10 U	4.7 U	4.7 U	4.7 U	6.9 J
Vanadium	4.5 (C)	13 (D)	7.0 U	0.65 J	0.75 J	0.64 U	0.64 U	0.64 U	7.0 U	0.64 U
Zinc	2,400	600	20 U	7.4 J	6.5 J	20 U	45	44.9	5.8 J	5.6 J

See notes at end of table.

Table 5
NBIA Operable Unit 1 Groundwater Delineation Study
Groundwater Monitoring Data Summary

Constituent	Groundwater Cleanup Goal (µg/L)		Constituent Concentration (µg/L)							
	Boundary Criterion	GSI Criterion	MW-6D (DUP)			MW-6S	MW-7S (DUP-2)		MW-8D	MW-8S
			2008	2010	2010	2008	2008	2008	2008	2008
<i>Cyanide</i>										
Total	200 (A)	--	6.6 J	6.1 B	10.0 U	5.0 U	11	10.9	5.0 U	5.0 U
Weak Acid Dissociable	--	5.6 (E)	1.6 U	10.0 U	10.0 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U
<i>Volatile Organic Compounds</i>										
1,1-Dichloroethene	--	--	3.8 U	20 U	20 U	0.19 U	0.19 U	0.19 U	3.2 U	0.48 U
1,2-Dichlorobenzene	--	--	2.6 U	20 U	20 U	0.13 U	0.51 J	0.5 J	2.2 U	0.32 U
1,2-Dichloroethene (total)	--	1,200	760	700	650	9.4	3.9	3.5	620	6.5
2-Butanone	--	--	11 U	500 U	500 U	0.57 U	0.57 U	0.57 U	9.5 U	1.4 U
Acetone	--	--	22 U	500 U	500 U	1.1 U	25 U	25 U	18 U	2.8 U
Carbon Disulfide	--	--	2.6 U	100 U	100 U	0.13 U	0.13 U	0.13 U	2.2 U	0.32 U
cis-1,2-Dichloroethene	70	670	710	670	620	8.2	3.9	3.5	540	6.5
Methylcyclohexane	--	--	2.6 U	20 U	20 U	0.13 U	0.55 J	0.54 J	2.2 U	0.32 U
trans-1,2-Dichloroethene	100 (A)	--	42	31	31	1.2	0.19 U	0.19 U	73	0.48 U
Trichloroethylene	5.0	210	25	26	25	10	0.17 U	0.17 U	2.8 U	0.42 U
Vinyl chloride	2.0	16	14 J	12 J	12 J	0.22 J	5.4	5.3	120	87

See notes at end of table.

Table 5
NBIA Operable Unit 1 Groundwater Delineation Study
Groundwater Monitoring Data Summary

Constituent	Groundwater Cleanup Goal (µg/L)		Constituent Concentration (µg/L)							
	Boundary Criterion	GSI Criterion	MW-26	MW-28 (DUP-1)		MW-29	MW-30	MW-31	MW-32I	MW-32S
			2008	2008	2008	2008	2008	2008	2008	2008
Metals										
Aluminum	--	--	97 U	97 U	97 U	97 U	97 U	97 U	97 U	97 U
Antimony	6.0 (C)	260 (D)	1.8 U	1.8 U	10 U	1.8 U	10 U	10 U	1.8 U	10 U
Arsenic	10 (A)	160	10.0 U	3.2 U	3.2 U	10.5	3.7 J	6.9 J	12.8	10.0 U
Barium	2,000 (A)	1,300	27.9 J	83.9 J	81.6 J	34.7 J	100 U	100 U	93.7 J	33.4 J
Cadmium	5.0	10	2.1	0.66 U	0.66 U	23.2	2.9	9.3	3.8	27.1
Calcium	--	--	91,800	93,900	91,600	108,000	83,900	103,000	96,600	112,000
Chromium	11 (B)	12 (B)	4.2 J	5 U	8.6	2.3 J	2.2 U	6.2	4.8 J	4.6 J
Cobalt	--	--	7 U	1.7 U	1.7 U	7 U	10.8	1.7 U	7 U	7 U
Copper	1,400 (C)	32	4.5 U	4.5 U	4.5 U	4.5 U	25 U	25 U	25 U	25 U
Iron	--	--	103	81 U	81 U	631	81 U	81 U	1,100	81 U
Lead	4.0	140	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U
Magnesium	--	--	20,900	22,200	21,700	23,200	19,700	25,500	23,300	24,700
Manganese	860 (C)	10,000 (D)	338	945	940	516	1,380	55.4	245	160
Nickel	100	140	91.6	3.9 J	4.7 J	88.3	192	191	177	348
Potassium	--	--	4,510	2,140	2,080	3,150	3,120	2,080	4,050	4,580
Selenium	50 (A)	5.4 (D)	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U
Sodium	--	--	18,200	11,400	11,200	15,400	7,650	13,300	31,800	20,700
Thallium	2.0 (A)	7.7 (D)	10 U	10 U	4.7 U	4.7 U	4.7 U	8.7 J	4.7 U	10 U
Vanadium	4.5 (C)	13 (D)	0.64 U	0.64 U	0.64 U	0.64 U	0.64 U	7.0 U	0.64 U	7 U
Zinc	2,400	600	20 U	20 U	20 U	20 U	11.5 J	7.4 J	20 U	20 U

See notes at end of table.

Table 5
NBIA Operable Unit 1 Groundwater Delineation Study
Groundwater Monitoring Data Summary

Constituent	Groundwater Cleanup Goal (µg/L)		Constituent Concentration (µg/L)							
	Boundary Criterion	GSI Criterion	MW-26	MW-28 (DUP-1)		MW-29	MW-30	MW-31	MW-32I	MW-32S
			2008	2008	2008	2008	2008	2008	2008	2008
Cyanide										
Total	200 (A)	--	5.0 U	5.0 U	5.0 U	5.0 U	5.7 J	5.0 U	9.3 J	5.0 U
Weak Acid Dissociable	--	5.6 (E)	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U
Volatile Organic Compounds										
1,1-Dichloroethene	--	--	2.3 J	0.95 U	0.95 U	1.5 U	2.7 U	2.7 U	3.2 U	1.3 U
1,2-Dichlorobenzene	--	--	1.0 U	0.65 U	0.65 U	1.0 U	1.9 U	1.9 U	2.2 U	0.87 U
1,2-Dichloroethene (total)	--	1,200	220	94	99	250	160	99	430	200
2-Butanone	--	--	4.6 U	2.8 U	2.8 U	4.6 U	8.1 U	8.1 U	9.5 U	3.8 U
Acetone	--	--	8.8 U	5.5 U	5.5 U	8.8 U	16 U	16 U	18 U	7.3 U
Carbon Disulfide	--	--	1 U	0.65 UJ	0.65 UJ	1 U	1.9 U	1.9 U	2.2 U	0.87 U
cis-1,2-Dichloroethene	70	670	170	80	85	240	110	66	410	180
Methylcyclohexane	--	--	1 U	0.65 U	0.65 U	1 U	1.9 U	1.9 U	2.2 U	0.87 U
trans-1,2-Dichloroethene	100 (A)	--	46	14	14	6.8 J	55	34	18	19
Trichloroethylene	5.0	210	260	170	170	12 U	490	390	87	160
Vinyl chloride	2.0	16	2.1 J	1.1 U	1.1 U	61	3.1 U	3.1 U	38	1.5 U

See notes at end of table.

Table 5
NBIA Operable Unit 1 Groundwater Delineation Study
Groundwater Monitoring Data Summary

Constituent	Groundwater Cleanup Goal (µg/L)		Constituent Concentration (µg/L)						
	Boundary Criterion	GSI Criterion	MW-33I		MW-33S	MW-36 (DUP-3)		MW-37	MW-38
			2008	2010	2008	2008	2008	2008	2008
Metals									
Aluminum	--	--	207	200 U	97 U	97 U	97 U	97 U	97 U
Antimony	6.0 (C)	260 (D)	1.8 U	10.0 U	10 U	10 U	10 U	10 U	10 U
Arsenic	10 (A)	160	10.0 U	9.4 J	3.2 U	11.9	12.3	150	8.7 J
Barium	2,000 (A)	1,300	134	127	100 U	116	124	82 J	96.3 J
Cadmium	5.0	10	0.66 U	2.0 U	0.66 U	0.66 U	0.66 U	0.66 U	0.66 U
Calcium	--	--	102,000	102,000	105,000	94,500	99,700	114,000	108,000
Chromium	11 (B)	12 (B)	2.2 U	5.0 U	5.4	2.2 U	2.2 U	2.2 U	2.2 U
Cobalt	--	--	1.7 U	7.0 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U
Copper	1,400 (C)	32	4.5 U	25.0 U	11.3 J	4.5 U	4.5 U	22.7 J	4.5 U
Iron	--	--	442	934	81 U	2,500	2,800	15,700	1,110
Lead	4.0	140	1.9 U	3.0 U	2.0 J	1.9 U	1.9 U	1.9 U	1.9 U
Magnesium	--	--	27,600	28,500	17,900	23,800	25,000	32,600	30,800
Manganese	860 (C)	10,000 (D)	124	88.6	42.5	189	200	317	157
Nickel	100	140	8.4 J	25.0 U	23.4 J	3.2 U	3.2 U	3.2 U	3.2 U
Potassium	--	--	2,850	2,480	4,790	3,580	3,830	498 J	908 J
Selenium	50 (A)	5.4 (D)	4.1 U	5.0 U	8.6	4.1 U	4.1 U	4.1 U	4.1 U
Sodium	--	--	23,500	25,500	1,750	29,600	32,100	5,660	4,150
Thallium	2.0 (A)	7.7 (D)	4.7 U	10.0 U	4.7 U	4.7 U	5.1 J	10 U	10 U
Vanadium	4.5 (C)	13 (D)	0.64 U	7.0 U	0.64 U	0.64 U	7.0 U	0.64 U	0.64 U
Zinc	2,400	600	20 U	20.0 U	20 U	5.0 U	7.3 J	26.6	20 U

See notes at end of table.

Table 5
NBIA Operable Unit 1 Groundwater Delineation Study
Groundwater Monitoring Data Summary

Constituent	Groundwater Cleanup Goal (µg/L)		Constituent Concentration (µg/L)						
	Boundary Criterion	GSI Criterion	MW-33I		MW-33S	MW-36 (DUP-3)		MW-37	MW-38
			2008	2010	2008	2008	2008	2008	2008
Cyanide									
Total	200 (A)	--	5.0 U	10.0 U	5.0 U	15.8	13.6	5.0 U	5.0 U
Weak Acid Dissociable	--	5.6 (E)	1.6 U	10.0 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U
Volatile Organic Compounds									
1,1-Dichloroethene	--	--	2.4 U	10 U	0.19 U	1.5 U	1.9 U	0.19 U	0.19 U
1,2-Dichlorobenzene	--	--	1.6 U	10 U	0.13 U	1.0 U	1.3 U	0.13 U	0.13 U
1,2-Dichloroethene (total)	--	1,200	360	350	1.4 J	360	390	0.34 U	0.34 U
2-Butanone	--	--	7.1 U	250 U	0.57 U	4.6 U	5.7 U	0.57 U	0.57 U
Acetone	--	--	14 U	250 U	1.1 U	8.8 U	11 U	1.1 U	1.1 U
Carbon Disulfide	--	--	1.6 U	50 U	0.13 U	1 U	1.3 U	0.13 UJ	0.13 UJ
cis-1,2-Dichloroethene	70	670	320	310	1.2	320	350	0.17 U	0.17 U
Methylcyclohexane	--	--	1.6 U	10 U	0.13 U	1.0 U	1.3 U	0.13 U	0.13 U
trans-1,2-Dichloroethene	100 (A)	--	40	36	0.23 J	38	42	0.19 U	0.19 U
Trichloroethylene	5.0	210	18	23	0.96 J	1.4 U	1.7 U	0.17 U	0.17 U
Vinyl chloride	2.0	16	21	24	0.22 U	86	93	0.22 U	0.22 U

See notes at end of table.

Table 5
NBIA Operable Unit 1 Groundwater Delineation Study
Groundwater Monitoring Data Summary

Constituent	Groundwater Cleanup Goal (µg/L)		Constituent Concentration (µg/L)								
	Boundary Criterion	GSI Criterion	MW-39		MW-40		MW-41	MW-42		MW-43	
			2008	2010	2008	2010	2010	2008	2010	2008	2010
Metals											
Aluminum	--	--	200 U	200 U	414	794	3,420	542	143 J	200 U	200 U
Antimony	6.0 (C)	260 (D)	10 U	3.1 J	1.8 U	10.0 U	10.0 U	10 U	3.7 J	10 U	10.0 U
Arsenic	10 (A)	160	4.9 J	10.2	7.2 J	13.8	6.2 J	9.1 J	83.0	10.0 U	10.0 U
Barium	2,000 (A)	1,300	85.6 J	81.5 J	154	149	179	105	109	100 U	62.2 J
Cadmium	5.0	10	0.66 U	2.0 U	0.66 U	2.0 U	2.0 U	0.66 U	2.0 U	0.66 U	2.0 U
Calcium	--	--	101,000	96,200	106,000	112,000	116,000	95,700	92,700	96,500	86,000
Chromium	11 (B)	12 (B)	2.2 U	5.0 U	5 U	2.6 J	10.1	5 U	5.0 U	2.2 U	5.0 U
Cobalt	--	--	1.7 U	7.0 U	2.4 J	7.0 U	3.0 J	1.7 U	7.0 U	1.7 U	7.0 U
Copper	1,400 (C)	32	4.5 U	25.0 U	4.5 U	25.0 U	16.4 J	4.5 U	25.0 U	4.5 U	25.0 U
Iron	--	--	713	1,310	2,170	1,780	7,250	1,980	3,510	111	189
Lead	4.0	140	1.9 U	3.0 U	1.9 U	3.0 U	2.6 J	1.9 U	3.0 U	1.9 U	3.0 U
Magnesium	--	--	24,100	23,600	29,100	30,800	33,100	24,200	22,900	24,300	23,500
Manganese	860 (C)	10,000 (D)	488	567	249	143	310	165	107	280	222
Nickel	100	140	3.2 U	25.0 U	126	14.5 J	19.2 J	11.5 J	5.5 J	14.9 J	10.2 J
Potassium	--	--	1,940	1,630	1,820	1,420	3,870	1,810	1,100	2,040	1,580
Selenium	50 (A)	5.4 (D)	4.1 U	5.0 U	4.1 U	5.0 U	5.0 U	4.1 U	5.0 U	4.1 U	5.0 U
Sodium	--	--	12,400	10,400	29,200	28,600	25,100	14,400	12,200	9,890	4,070
Thallium	2.0 (A)	7.7 (D)	4.7 U	10.0 U	10 U	5.3 J	10.0 U	4.7 U	5.6 B	10 U	10.0 U
Vanadium	4.5 (C)	13 (D)	0.64 U	7.0 U	0.77 J	1.7 J	8.4	1.2 J	7.0 U	0.64 U	7.0 U
Zinc	2,400	600	20 U	7.2 J	20 U	9.7 J	32.2	20 U	20.0 U	20 U	20.0 U

See notes at end of table.

Table 5
NBIA Operable Unit 1 Groundwater Delineation Study
Groundwater Monitoring Data Summary

Constituent	Groundwater Cleanup Goal (µg/L)		Constituent Concentration (µg/L)								
	Boundary Criterion	GSI Criterion	MW-39		MW-40		MW-41	MW-42		MW-43	
			2008	2010	2008	2010	2010	2008	2010	2008	2010
Cyanide											
Total	200 (A)	--	5.0 U	7.2 J	5.0 U	5.4 B	10.0 U	5.0 U	5.4 J	5.0 U	10.0 U
Weak Acid Dissociable	--	5.6 (E)	1.6 U	10.0 U	1.6 U	10.0 U	10.0 U	1.6 U	10.0 U	1.6 U	10.0 U
Volatile Organic Compounds											
1,1-Dichloroethene	--	--	0.19 U	1.0 U	0.19 U	1.0 U	1.0 U	0.19 U	1.0 U	1.3 U	1.7 U
1,2-Dichlorobenzene	--	--	0.13 U	1.0 U	0.13 U	1.0 U	1.0 U	0.13 U	1.0 U	0.87 U	1.7 U
1,2-Dichloroethene (total)	--	1,200	12	7.8	0.34 U	2.0 U	2.0 U	0.34 U	2.0 U	200	69
2-Butanone	--	--	0.57 U	25 U	0.57 U	25 U	25 U	0.57 U	25 U	3.8 U	42 U
Acetone	--	--	1.1 U	25 U	1.1 U	25 U	2.7 J	1.1 U	25 U	7.3 U	42 U
Carbon Disulfide	--	--	0.13 UJ	5.0 U	0.13 UJ	5.0 U	5.0 U	0.13 UJ	5.0 U	0.87 U	8.4 U
cis-1,2-Dichloroethene	70	670	11	7.4	0.17 U	1.0 U	1.0 U	0.17 U	1.0 U	170	58
Methylcyclohexane	--	--	0.13 U	1.0 U	0.13 U	1.0 U	1.0 U	0.13 U	1.0 U	0.87 U	1.7 U
trans-1,2-Dichloroethene	100 (A)	--	0.69 J	0.4 J	0.19 U	1.0 U	1.0 U	0.19 U	1.0 U	34	11
Trichloroethylene	5.0	210	0.17 U	1.0 U	0.17 U	1.0 U	1.0 U	0.17 U	1.0 U	110	62
Vinyl chloride	2.0	16	1.6	1.2	0.26 J	0.50 J	2.1	0.22 U	0.50 J	1.5 U	1.7 U

See notes at end of table.

Table 5
NBIA Operable Unit 1 Groundwater Delineation Study
Groundwater Monitoring Data Summary

Constituent	Groundwater Cleanup Goal (µg/L)		Constituent Concentration (µg/L)						
	Boundary Criterion	GSI Criterion	MW-44S		MW-44D		MW-45S (DUP)		
			2008	2010	2008	2010	2008	2010	2010
Metals									
Aluminum	--	--	97 U	200 U	224	200 U	228	200 U	200 U
Antimony	6.0 (C)	260 (D)	10 U	10.0 U	1.8 U	10.0 U	1.8 U	10.0 U	10.0 U
Arsenic	10 (A)	160	3.2 U	10.0 U	4.8 J	5.1 J	4.1 J	4.7 J	10.0 U
Barium	2,000 (A)	1,300	100 U	73.4 J	68.5 J	66.7 J	79.2 J	69.8 J	69.6 J
Cadmium	5.0	10	0.66 U	2.0 U	0.66 U	2.0 U	0.66 U	2.0 U	2.0 U
Calcium	--	--	107,000	107,000	99,200	105,000	101,000	98,300	98,000
Chromium	11 (B)	12 (B)	2.2 U	6.3	2.2 U	7.5	5.2	5.0 U	5.0 U
Cobalt	--	--	1.7 U	7.0 U	1.7 U	7.0 U	1.7 U	7.0 U	7.0 U
Copper	1,400 (C)	32	4.5 U	25.0 U	4.5 U	25.0 U	9.9 J	25.0 U	25.0 U
Iron	--	--	81 U	127	1,180	2,280	731	751	667
Lead	4.0	140	1.9 U	3.0 U	1.9 U	3.0 U	1.9 U	3.0 U	3.0 U
Magnesium	--	--	25,200	26,600	24,800	26,200	28,400	27,900	27,900
Manganese	860 (C)	10,000 (D)	51.1	31.8	100	65.0	144	122	121
Nickel	100	140	11.8 J	8.3 J	11.8 J	25.0 U	16.8 J	10 J	10.9 J
Potassium	--	--	1,490	1,510	2,050	2,040	1,620	1,390	1,390
Selenium	50 (A)	5.4 (D)	4.1 U	5.0 U	4.1 U	5.0 U	4.1 U	5.0 U	5.0 U
Sodium	--	--	14,900	17,100	30,700	31,600	23,900	15,600	15,700
Thallium	2.0 (A)	7.7 (D)	4.7 U	10.0 U	10 U	10.0 U	10 U	10.0 U	10.0 U
Vanadium	4.5 (C)	13 (D)	0.64 U	7.0 U	0.64 U	7.0 U	7.0 U	7.0 U	7.0 U
Zinc	2,400	600	20 U	20.0 U	20 U	20.0 U	20 U	20.0 U	5.8 J

See notes at end of table.

Table 5
NBIA Operable Unit 1 Groundwater Delineation Study
Groundwater Monitoring Data Summary

Constituent	Groundwater Cleanup Goal (µg/L)		Constituent Concentration (µg/L)						
	Boundary Criterion	GSI Criterion	MW-44S		MW-44D		MW-45S (DUP)		
			2008	2010	2008	2010	2008	2010	2010
<i>Cyanide</i>									
Total	200 (A)	--	5.0 U	10.0 U	9.6 J	10.0 U	12.2	10.0 U	10.0 U
Weak Acid Dissociable	--	5.6 (E)	1.6 U	10.0 U	1.6 U	10.0 U	1.6 U	10.0 U	10.0 U
<i>Volatile Organic Compounds</i>									
1,1-Dichloroethene	--	--	0.95 U	8.0 U	2.7 U	17 U	1.5 U	9.1 U	9.1 U
1,2-Dichlorobenzene	--	--	0.65 U	8.0 U	1.9 U	17 U	1.0 U	9.1 U	9.1 U
1,2-Dichloroethene (total)	--	1,200	150	280	540	520	330	330	350
2-Butanone	--	--	2.8 U	200 U	8.1 U	420 U	4.6 U	230 U	230 U
Acetone	--	--	5.5 U	24 J	16 U	420 U	8.8 U	19 J	230 U
Carbon Disulfide	--	--	0.65 U	40 U	1.9 U	83 U	1 U	45 U	45 U
cis-1,2-Dichloroethene	70	670	140	260	520	490	310	300	310
Methylcyclohexane	--	--	0.65 U	8.0 U	1.9 U	17 U	1.0 U	9.1 U	9.1 U
trans-1,2-Dichloroethene	100 (A)	--	9.9	17	26	27	27	29	32
Trichloroethylene	5.0	210	54	77	2.4 U	17 U	34	29	31
Vinyl chloride	2.0	16	17	23	12 J	12.0 J	1.8 J	3.5 J	3.4 J

See notes at end of table.

Table 5
NBIA Operable Unit 1 Groundwater Delineation Study
Groundwater Monitoring Data Summary

Constituent	Groundwater Cleanup Goal (µg/L)		Constituent Concentration (µg/L)					
	Boundary Criterion	GSI Criterion	MW-45D		MW-46	MW-47	MW-48	MW-49
			2008	2010	2010	2010	2010	2010
Metals								
Aluminum	--	--	698	244	693	357	200 U	1080
Antimony	6.0 (C)	260 (D)	1.8 U	10.0 U	10.0 U	10.0 U	2.1 J	2.3 J
Arsenic	10 (A)	160	7.3 J	9.0 J	10.0 U	6.2 J	11.2	5.3 J
Barium	2,000 (A)	1,300	102	96.8 J	162	135	73.5 J	163
Cadmium	5.0	10	0.66 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Calcium	--	--	101,000	101,000	96,700	105,000	85,900	98,700
Chromium	11 (B)	12 (B)	3.2 J	5.0 U	5.0 U	5.0 U	5.0 U	4.2 J
Cobalt	--	--	1.7 U	7.0 U	7.0 U	7.0 U	7.0 U	7.0 U
Copper	1,400 (C)	32	19 J	5.6 J	25.0 U	25.0 U	25.0 U	5.0 J
Iron	--	--	2,010	1,670	1,270	1,930	1,140	1,810
Lead	4.0	140	1.9 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
Magnesium	--	--	26,300	26,800	24,500	28,900	20,300	27,100
Manganese	860 (C)	10,000 (D)	130	109	338	153	352	160
Nickel	100	140	6.9 J	6.1 J	3.8 J	21.4 J	25.0 U	3.5 J
Potassium	--	--	2,030	2,010	3,680	2,400	2,040	3,600
Selenium	50 (A)	5.4 (D)	4.1 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Sodium	--	--	34,900	34,700	16,600	29,900	21,500	31,600
Thallium	2.0 (A)	7.7 (D)	10 U	7.7 J	10.0 U	10.0 U	10.0 U	7.4 B
Vanadium	4.5 (C)	13 (D)	7.0 U	7.0 U	7.0 U	0.70 J	7.0 U	3.5 J
Zinc	2,400	600	20 U	20.0 U	9.4 J	6.1 J	20.0 U	15.0 J

See notes at end of table.

Table 5
NBIA Operable Unit 1 Groundwater Delineation Study
Groundwater Monitoring Data Summary

Constituent	Groundwater Cleanup Goal (µg/L)		Constituent Concentration (µg/L)					
	Boundary Criterion	GSI Criterion	MW-45D		MW-46	MW-47	MW-48	MW-49
			2008	2010	2010	2010	2010	2010
<i>Cyanide</i>								
Total	200 (A)	--	5.0 U	10.0 U	10.0 U	10.0 U	7.2 J	10.0 U
Weak Acid Dissociable	--	5.6 (E)	1.6 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
<i>Volatile Organic Compounds</i>								
1,1-Dichloroethene	--	--	3.2 U	17 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichlorobenzene	--	--	2.2 U	17 U	1.0 U	1.0 U	1.0 U	1.0 U
1,2-Dichloroethene (total)	--	1,200	780	640	2.0 U	2.0 U	3.5	2.0 U
2-Butanone	--	--	9.5 U	420 U	25 U	25 U	25 U	25 U
Acetone	--	--	18 U	420 U	25 U	25 U	25 U	1.8 J
Carbon Disulfide	--	--	2.2 U	83	5.0 U	5.0 U	5.0 U	5.0 U
cis-1,2-Dichloroethene	70	670	650	530	1.0 U	1.0 U	3.5	1.0 U
Methylcyclohexane	--	--	2.2 U	17 U	1.0 U	1.0 U	1.0 U	1.0 U
trans-1,2-Dichloroethene	100 (A)	--	130	100	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethylene	5.0	210	10 J	7.4 J	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl chloride	2.0	16	17	17.0	1.0 U	4.0	4.7	6.6

See notes at end of table.

Table 5

NBIA Operable Unit 1 Groundwater Delineation Study

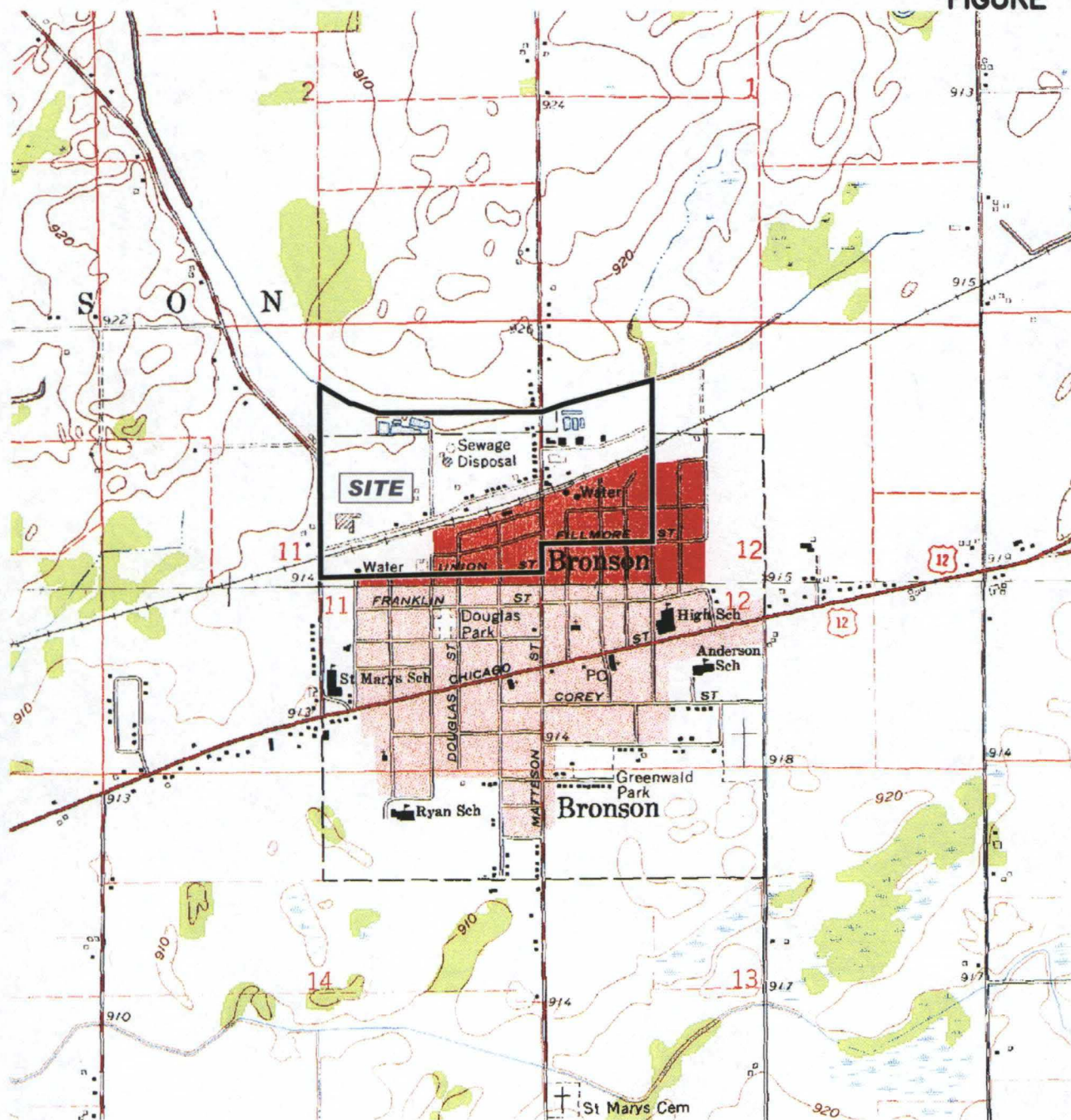
Groundwater Monitoring Data Summary

Notes:

1. For ground water well locations, see Figure 2.
2. Only constituents detected in one or more groundwater samples are listed in this table. See Appendix E for analytical reports and complete analytical results.
3. All concentrations reported in units of micrograms per liter ($\mu\text{g/L}$).
4. Validation was conducted for all data. See Appendix F for data validation report.
5. Unless otherwise indicated, Groundwater Cleanup Goals are from the following:
Boundary Criteria - 1998 Record of Decision (ROD)
GSI Criteria - September 16, 2008 MDEQ Memorandum, "Venting Groundwater Mixing Zone Review - Revised."
6. Notes on Groundwater Cleanup Goals:
 (A) - Indicates state of Michigan residential health-based drinking water standard established pursuant to Section 5 of 1976 PA 399, MCL 325.1005 used as a surrogate Boundary Criterion for those constituents for which a GSI criterion applies but no Boundary Criterion was defined in the ROD.
 (B) - Groundwater Cleanup Goals based on hexavalent chromium concentrations.
 (C) - Indicates health-based drinking water value provided in MDEQ RRD Operational Memorandum No. 1, used as a surrogate Boundary Criterion for those constituents for which a GSI criterion applies but no Boundary Criterion was defined in the ROD.
 (D) - Indicates site-specific GSI Criterion calculated based on MDEQ Water Bureau procedures but not listed in September 16, 2008 MDEQ Memorandum.
 (E) - Weak acid dissociable cyanide is used as a conservative indicator of free cyanide upon which the GSI Criterion is based.
 -- - Indicates no applicable Groundwater Cleanup Goal.
7. Notes on Groundwater Data:
 For clarity, all detections are shown in **bold-face** type.
 Concentrations above Boundary Criteria (or surrogates) are shown in **blue** type.
 Concentrations above GSI Criteria are shown with yellow shading.
8. Data Qualifiers:
 U - Constituent not detected at indicated Reporting Limit (RL)
 J - Estimated concentration detected above minimum detection limit (MDL), but below RL.

FIGURES

FIGURE 1



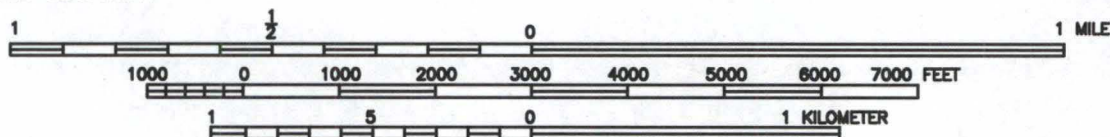
ADAPTED FROM: BRONSON NORTH AND BRONSON SOUTH, MI U.S.G.S. 7.5 MIN. QUAD



MICHIGAN
QUADRANGLE LOCATION

NORTH BRONSON INDUSTRIAL AREA SUPERFUND SITE BRONSON, MICHIGAN

SITE LOCATION MAP



FILE NO. 12716.
JULY 2010

SCALE: 1:24000

NOTE: SITE AREA IN FIGURE 1 PER RECORD OF DECISION (MDEQ AND USEPA, 1998)



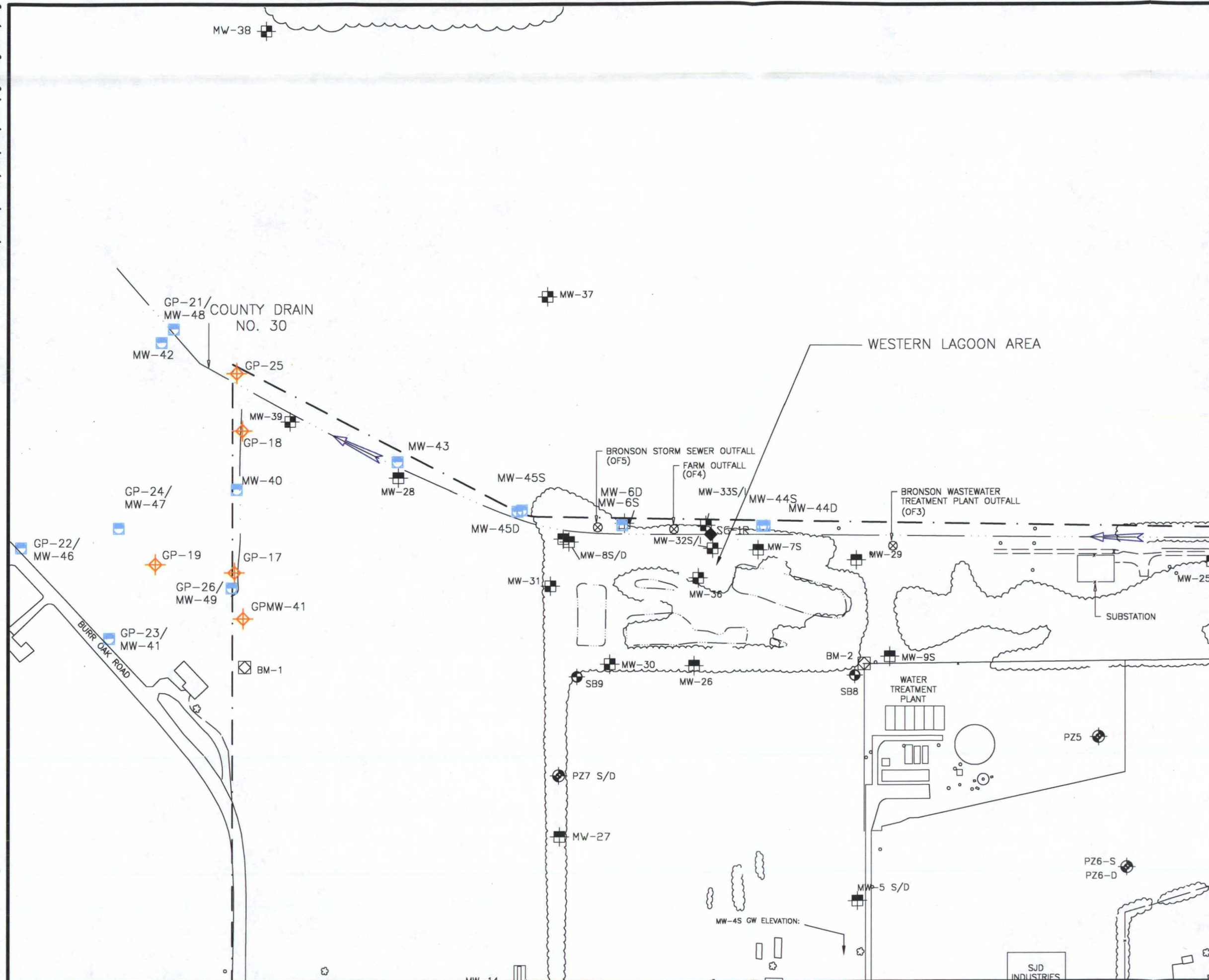


FIGURE 2

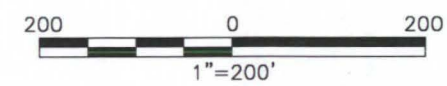


LEGEND

- APPROXIMATE SITE BOUNDARY
- VAP MONITORING WELL LOCATION
- ◇ TEMPORARY VERTICAL AQUIFER PROFILE LOCATION
- ◆ STAFF GAUGE
- ⊕ RI MONITORING WELL
- ⊙ SOIL BORING LOCATION AND NUMBER
- ⊠ PRE-DESIGN MW
- ⊗ PIEZOMETER LOCATION AND NUMBER
- ➡ SURFACE-WATER FLOW DIRECTION

**NORTH BRONSON
INDUSTRIAL AREA SITE
OPERABLE UNIT 1
BRONSON, MICHIGAN**

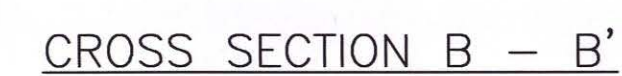
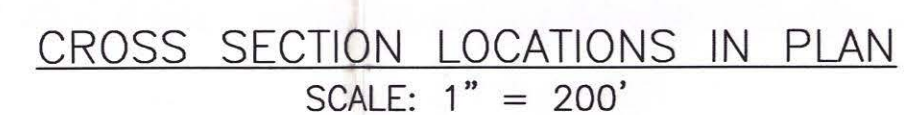
SITE LAYOUT



FILE NO. 12716.41845.020
AUGUST 2010



2007 © O'Brien & Gere Engineers, Inc.



TYPICAL WELL DETAIL

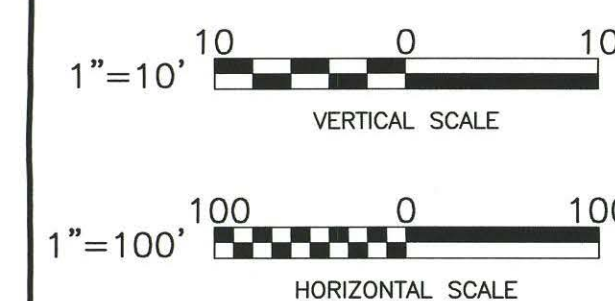
CASING

SCREEN

The diagram shows a vertical cross-section of a well. The upper portion is labeled 'CASING' and is represented by a solid black vertical bar. The lower portion is labeled 'SCREEN' and is represented by a vertical bar with horizontal white segments, indicating a filter screen. Arrows point from the text labels to their respective parts in the diagram.

NORTH BRONSON
INDUSTRIAL AREA SITE
OPERABLE UNIT 1
BRONSON, MICHIGAN

GEOLOGIC CROSS SECTIONS



FILE NO. 12716.41845 - 003
DECEMBER 2008



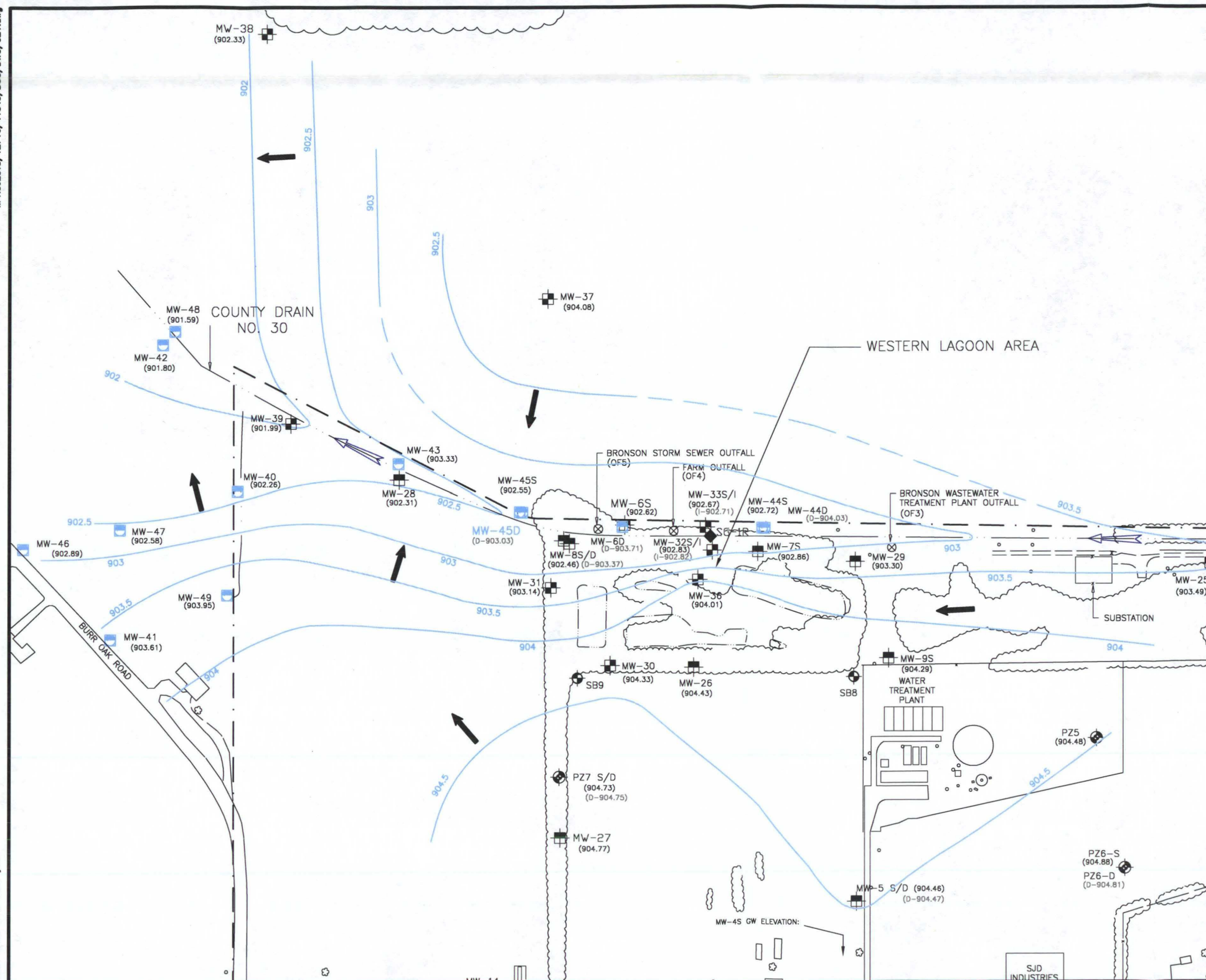


FIGURE 4

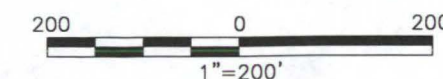
NORTH

LEGEND

- APPROXIMATE SITE BOUNDARY
- VAP MONITORING WELL LOCATION
- ◆ STAFF GAUGE
- ⊕ RI MONITORING WELL
- ⊙ SOIL BORING LOCATION AND NUMBER
- ⊕ PRE-DESIGN MW
- ⊙ PIEZOMETER LOCATION AND NUMBER
- SURFACE-WATER FLOW DIRECTION
- GENERAL GROUND WATER FLOW DIRECTION
- GROUND WATER CONTOUR LINE
- (902.86) SHALLOW OR SINGULAR WELL GROUND WATER ELEVATION DATA
- (903.57) DEEP OR INTERMEDIATE WELL GROUND WATER ELEVATION DATA

**NORTH BRONSON
INDUSTRIAL AREA SITE
OPERABLE UNIT 1
BRONSON, MICHIGAN**

**GROUNDWATER
CONTOUR MAP
JUNE 7, 2010**



FILE NO. 12716.41845.021
AUGUST 2010



2007 © O'Brien & Gere Engineers, Inc.

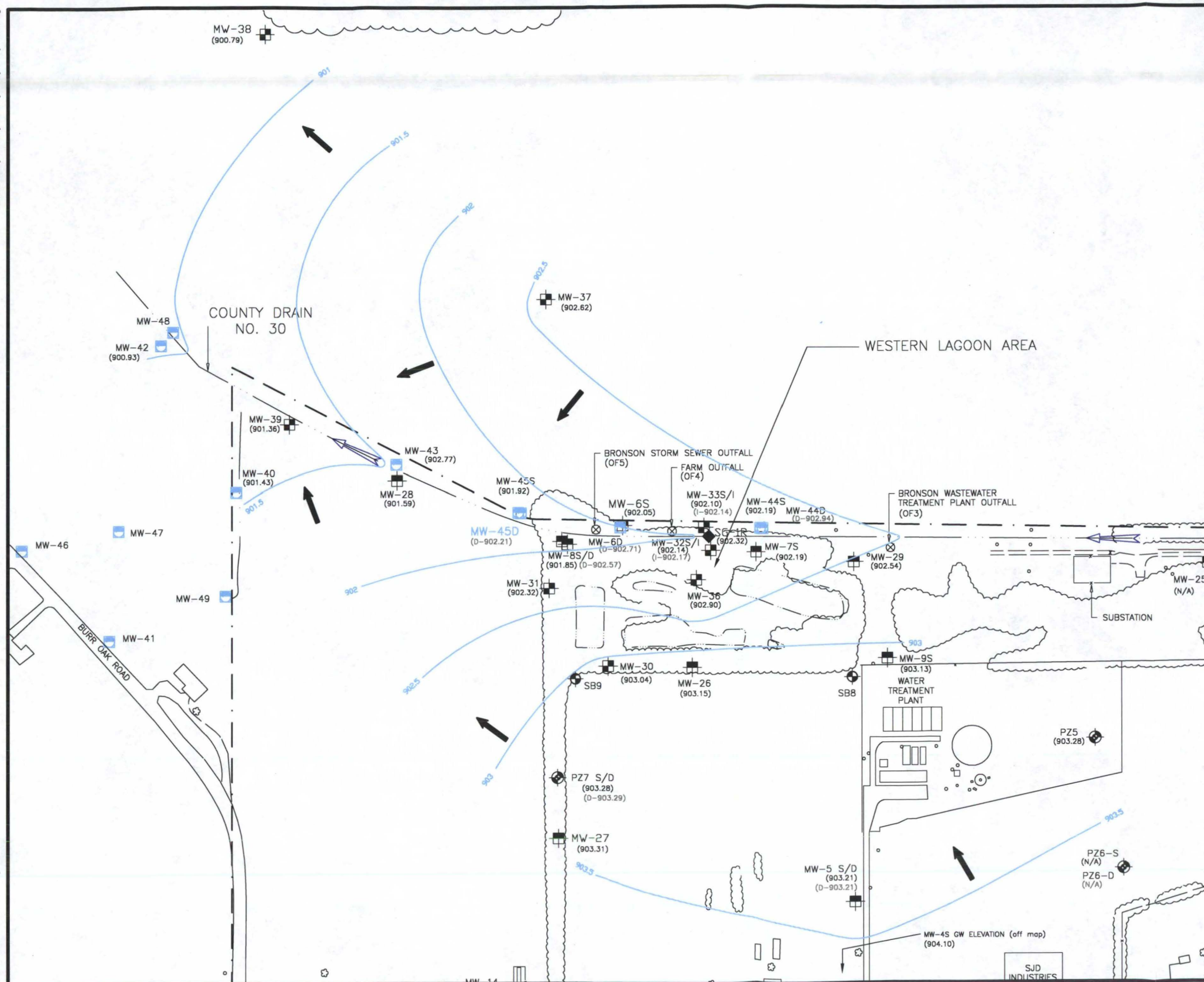


FIGURE 5

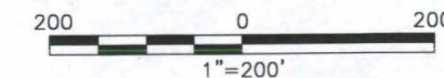


LEGEND

- APPROXIMATE SITE BOUNDARY
- VAP MONITORING WELL LOCATION
- ◆ STAFF GAUGE
- ⊕ RI MONITORING WELL
- ⊙ SOIL BORING LOCATION AND NUMBER
- ⊕ PRE-DESIGN MW
- ⊙ PIEZOMETER LOCATION AND NUMBER
- ➡ SURFACE-WATER FLOW DIRECTION
- ➡ GENERAL GROUND WATER FLOW DIRECTION
- GROUND WATER CONTOUR LINE
- (902.71) SHALLOW OR SINGULAR WELL GROUND WATER ELEVATION DATA
- (903.57) DEEP OR INTERMEDIATE WELL GROUND WATER ELEVATION DATA

**NORTH BRONSON
INDUSTRIAL AREA SITE
OPERABLE UNIT 1
BRONSON, MICHIGAN**

**GROUNDWATER
CONTOUR MAP
OCTOBER 13, 2008**



FILE NO. 12716.41845.022
AUGUST 2010



2007 © O'Brien & Gere Engineers, Inc.

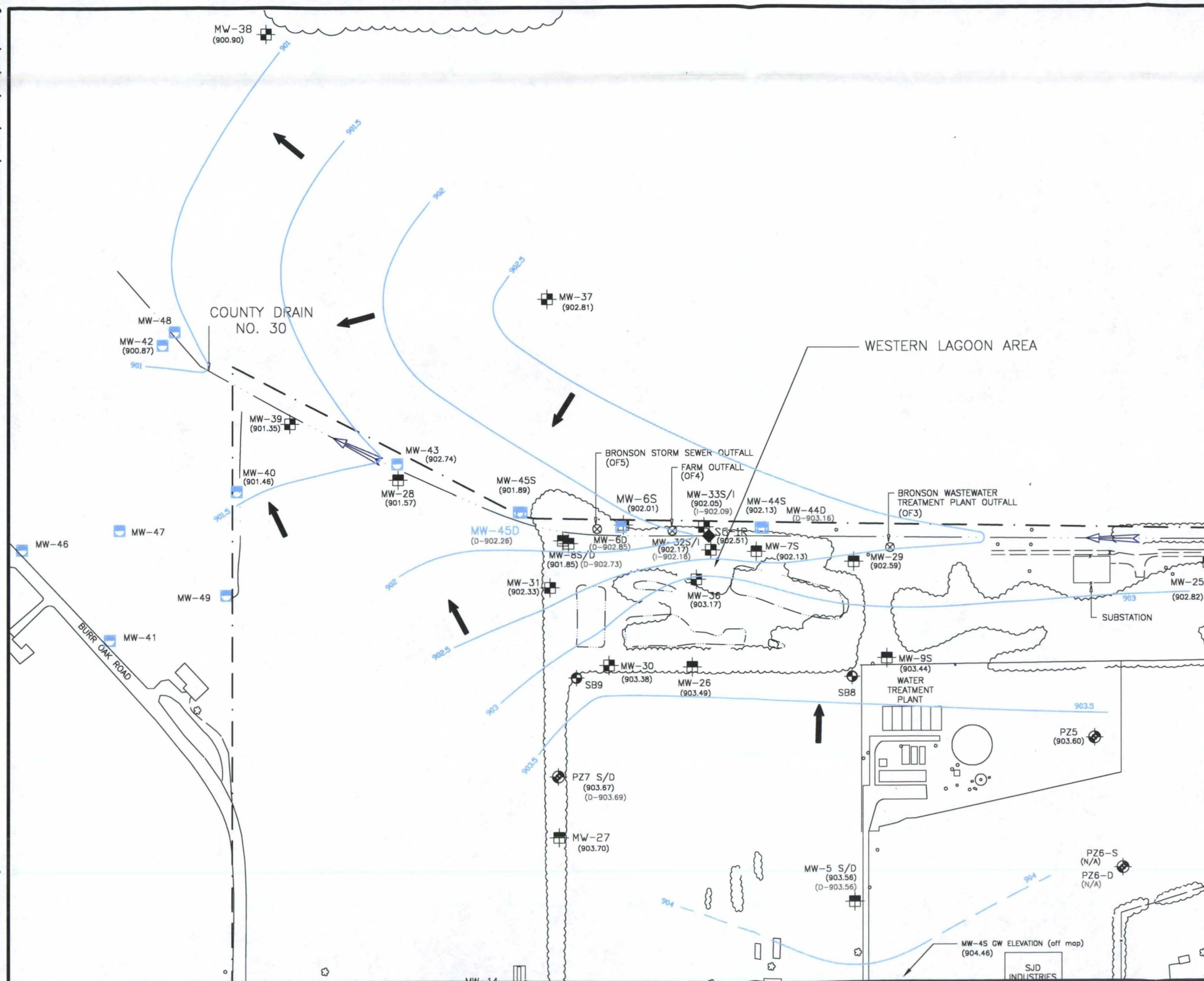


FIGURE 6

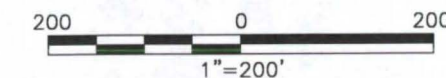
NORTH

LEGEND

- APPROXIMATE SITE BOUNDARY
- VAP MONITORING WELL LOCATION
- ◆ STAFF GAUGE
- ⊕ RI MONITORING WELL
- ⊕ SOIL BORING LOCATION AND NUMBER
- ⊕ PRE-DESIGN MW
- ⊕ PIEZOMETER LOCATION AND NUMBER
- SURFACE-WATER FLOW DIRECTION
- GENERAL GROUND WATER FLOW DIRECTION
- GROUND WATER CONTOUR LINE
- (902.71) SHALLOW OR SINGULAR WELL GROUND WATER ELEVATION DATA
- (903.57) DEEP OR INTERMEDIATE WELL GROUND WATER ELEVATION DATA

**NORTH BRONSON
INDUSTRIAL AREA SITE
OPERABLE UNIT 1
BRONSON, MICHIGAN**

**GROUNDWATER
CONTOUR MAP
JANUARY 22, 2009**



FILE NO. 12716.41845.023
AUGUST 2010



2007 © O'Brien & Gere Engineers, Inc.

(b) (6)

I:\12716\41485\Doc\Draw\005 - CVOCs In GW.dwg

12/23/08 JPH Dk076

FIGURE 7



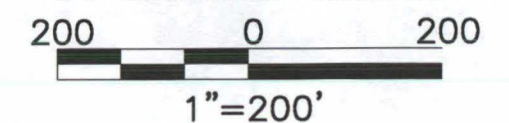
LEGEND

- APPROXIMATE SITE BOUNDARY
- VAP MONITORING WELL LOCATION
- ⊕ TEMPORARY VERTICAL AQUIFER PROFILE LOCATION
- STAFF GAUGE
- GEOPROBE LOCATION
- ⊕ PRE-RI MONITORING WELL
- ⊕ RI MONITORING WELL
- ⊕ SOIL BORING LOCATION AND NUMBER
- ⊕ PRE-DESIGN MW
- ⊕ MONITORING WELL - BRONSON PRECISION PRODUCT
- ⊕ PIEZOMETER LOCATION AND NUMBER
- ⊕ PRIVATE WELL LOCATION
- TOTAL CVOC's (ug/L)
- 0-1.99
- 2-10
- 10.01 - 100
- 100.01 - 1000
- 1000.01 - 5000
- ESTIMATED EXTENT OF CVOC IN GROUND WATER

**NORTH BRONSON
INDUSTRIAL AREA SITE
OPERABLE UNIT 1
BRONSON, MICHIGAN**

DRAFT

**EXTENT OF
CHLORINATED VOCs
IN GROUND WATER**



FILE NO. 12716.41485 - 005
DECEMBER 2008



2008 © O'Brien & Gere Engineers, Inc.

(b) (6)

FIGURE 8

LEGEND

APPROXIMATE SITE BOUNDARY



VAP MONITORING
WELL LOCATION



TEMPORARY VERTICAL
AQUIFER PROFILE LOCATION



STAFF GAUGE



GEOPROBE LOCATION



PRE-RI MONITORING WELL



RI MONITORING WELL



SOIL BORING LOCATION AND NUMBER



PRE-DESIGN MW



MONITORING WELL - BRONSON PRECISION
PRODUCT



PIEZOMETER LOCATION AND NUMBER



PRIVATE WELL LOCATION

SELECTED PARCEL PROPERTY
LINES AND PARCEL NUMBERS

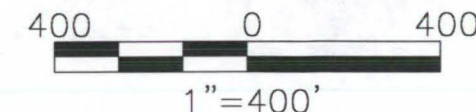
ESTIMATED EXTENT OF
CVOCs IN GROUND WATER

NOTES:

- 1) PARCEL PROPERTY LINES ARE APPROXIMATE AND BASED ON LEGAL DESCRIPTIONS AND ON OCCUPANCY
- 2) LEGAL DESCRIPTIONS PROVIDED BY BRANCH COUNTY PROPERTY AND LAND SEARCH WEBSITE

**NORTH BRONSON
INDUSTRIAL AREA SITE
OPERABLE UNIT 1
BRONSON, MICHIGAN**

**BRONSON
TOWNSHIP PROPERTIES
WITH POTENTIALLY
AFFECTED GROUNDWATER**



FILE NO. 12716.41845.013
AUGUST 2010



2010 © O'Brien & Gere Engineers, Inc.

APPENDICES

Appendix A
Field Notes

88 5/3/10 additional VAP sampling

900 km, shoulder (SSG), Cliff Yatz (SSG)

10m Ulrich (stars) on site

discussed sample location and

unloaded equipment

930 Met w/ gas company - marked gas lines. ^{Toby}

and location along Burr Oak road

Sunny, 65°F

1000 Gas company off site

1150 Moved to GP-25

15-20' from bridge N side of ditch

10:50 - Soil sampling at GP-25

MT Gas (Toby) said we could be

within 3 ft of gas main with our

DM Mtg / Yarning - mark is buried

at about 36"-40"

I met with Randy King to

Clear GP-24 location with him.

5/3/10

5/3/10

89

the said was not happy at all with the location because it's hard to go around wells, even if they only stick a few feet into the field. We moved the location ~ 38' outside of the actual watering traveller's path so it doesn't get in the way. He's fine with the two at the edge of the field along Burr Oak, especially because there are flush mounts. He asked us to let MURKIE US EPA that we're not happy with all these wells and if and when they could be abandoned, they should be.

1230 finished drilling at GP-25

clay at 27.5-30' F08-30'

see boring logs for more detail

0-19.5 SAND

19.5-20 clay

20-27.5 SAND

27.5-30 clay

5/3/10

90 5/3/10 N/A Additional VAP Sampling

Sample intervals for GP-25

3.5 - 7.5 / 7.5 - 11.5 / 15.5 - 19.5

23.5 - 27.5

GP-25-VAP DTW 4.01 from Ground Surface
27.5 ft

GP-25-VAP 27.5

monitored for 60 min

turb low - 33 NTU

4 gal collected

1420 collected sample, cliff said wait till turb is low until sampling not just within 10%

Moved up to GP-25-VAP 19.5

purged 10 min prior to monitoring

DTW 4.42 from Ground Surface

GP-25-VAP 19.5

purged 10 min prior to monitoring

turb - 113 NTU

5 gal collected

1535 collected sample

GP-25-VAP 11.5 DTW 3.24 GS

purged 10 min prior to monitoring

turb - 65 NTU

4 gal collected

1650 collected sample

5/3/10 N/A Additional VAP Sampling 91

GP-25-VAP 7.5

purged 10 min prior to monitoring

turb 52 NTU / pumping rate ml

gal collected

DTW at GS

collected sample

1800

GP-25

5/4/10

5/4/10	92	NBIA Additional VAP sampling	Robin Smayda (CBS), Tom V (Cuck (Stems))	730	On site	800	Pressure gauged GP-25	Moved to GP-24 and decaed equipment	8:30 CSX on site egg style	900	Began Drilling GP-24	GP-24	see boring log for more detail	0-10.8 Sand	10.8-20 Clay	20-27.2 Sand	27.7-27.5 clay	Sample interval	3-7	7-11	20-24	1140	Began monitoring GP-24-VAP 24	purged 20 min prior to monitoring	monitored 40 min	DN 10.74 pumping rate 120 ml	turb 6.7 at sampling - 2 gal collected	collected sample at 1245	1242
--------	----	------------------------------	--	-----	---------	-----	-----------------------	-------------------------------------	---------------------------------------	-----	----------------------	-------	--------------------------------	-------------	--------------	--------------	----------------	-----------------	-----	------	-------	------	-------------------------------	-----------------------------------	------------------	------------------------------	--	--------------------------	------

5/4/10	NBIA	Additional VAP sampling	9-3	1325	Began monitoring at GP-24-VAP 11	purged 10 min prior to monitoring	monitored 60 min	DN 6.35 / pumping rate 50 ml	tub SD at sampling / 1 gal collected	1425	collected sample at 1425	Began monitoring at GP-24-VAP 7	purged 10 min prior to monitoring / monitored 60 min	DN 4.99 at CS / pumping rate 140 ml	turb 2.0 at sampling / 4.5 gal collected	1540	collected sample at 1540	1600	pressure gauged GP-24	decaed equipment	1700	Cliff Xantz off site taking samples to fcd EX	1730	Moved to location GP-23	18	off site
--------	------	-------------------------	-----	------	----------------------------------	-----------------------------------	------------------	------------------------------	--------------------------------------	------	--------------------------	---------------------------------	--	-------------------------------------	--	------	--------------------------	------	-----------------------	------------------	------	---	------	-------------------------	----	----------

94 8/5/10 NBIA Additional VAP sampling

730 ^{on site} Kevin Smader (GSA) Tom Ulrich (Stroms)

740 Began drilling at GP-23

920 Mike Robison (GSA) on site

1140 Phone call w/ Cliff Yates discussed sample intervals at GP-23

see boring log for more detail

0-3.6 Sand

3.6-4.1 clay

4.1-5.4 Sand

5.4-6 clay

6-19 Sand

19-20 clay

20-21.4 Sand

21.4-22.1 clay

22.1-24.5 Sand

24.5-30 clay

30-31 Sand

31-33 clay

33-36.3 Sand

36.3-40 clay

sample intervals per Cliff Yates

7-11' 20-24' 32-36'

15-19' 25.5-29.5'

5/5/10 NBIA Additional VAP sampling

95

Set well screen at GP-23-VAP 30

DTW 7.00 Ground surface

1020 Pumped 10 min prior to ~~pump~~ monitoring
pumping rate 120 ml / 3 gal collected
turb 117 waited 60 min before sampling

Moved and began GP-23-VAP 29.5

DTW 7.35 Ground surface

Pumped 10 min prior to monitoring - 1330
pumping rate 160 ml / 4 gal collected
turb 450 waited 60 min before sampling 1430

Miss marked sample 10s need "GW" in front of 10

1435 moved to and began GWGP-23-VAP 24

DTW 6.18 Ground surface

pumped 13 min prior to monitoring - 1437
pumping rate 140 / 4 gal collected
turb 1100 throughout Monitored 60 min

1540 home owner for area where we staged equipment on site. said it was fine to park as long as no runs were made. or at least fixed

5/5/10 NBIA Additional sampling

1550 Moved to and began GWGP-23-VAP19
 DTW 7.46 ground surface
 pumped 10 min prior to monitoring - 1550
 pumping rate 100 ml / 4 gal collected
 turb 316 NTU 60 min before sampling
 1650 collected at 1650

1655 Moved to and began GWGP-23-VAP19 ¹⁶⁵⁵
 DTW 6.28 ground surface
 pumped 10 min prior to monitoring - 1700
 pumping rate 140 ml
 turb 32 NTU 45 min sampling
 turb 24 NTU after sampling
 1745 collected at 1745

1750 cleaned up equipment

1802 off site

5/6/10 NBIA Additional sampling

97

730 ¹⁶⁵⁵ Kari Schneider (OSG), Mike Robison (OSG) Tom Ulrich (Staers)
 on site

735 Began pressure grouting GP-23

805 began equipment and drilling rods

830 moved to and began drilling at GP-22
 project # groundwater detection
~~48~~ 4/845 008.001

Equipment used Geopline 6020DT

at 25' hit glacial till

1046 called Cliff Yartz to discuss sample interval

0-18.6 sand

18.6-20 clay

20-25 sand

25-30 clay

sample interval for CSY

7-11

13-17

21-25

5/6/10
98 NBIA Additional VAP Sampling

1130 began GWGP-22-VAP 25

purged 10 min prior to monitoring - 1135

DTW 10.31 ground surface

tubing at screen midpoint / pumping rate 150 ml

4 gal collected / turb 45

1225 collected at 1225

1230 Began and moved to GWGP-22-VAP 17

DTW 6.95 ground surface

tubing at midpoint of screen

purged 10 min prior to monitoring - 12:40

moved tubing up and down screen for development

pumping rate 150 ml / 3 gal collected

1340 turb 48 / collected at 1340

1345 Began and moved up to GWGP-22-VAP 11

DTW 7.09 ground surface

tubing at midpoint of screen

1350 purged 8 min prior to monitoring - 1352

moved tubing up and down screen for development

pumping rate 120 ml / collected 3 gal

1450 collected at 1450 / turb 41 at sampling

1500 began pressure grouting GWGP-22

1600 Mike Robison off site to deliver samples to PDE

5/6/10 NBIA Additional Sampling 99

Measured distance between GP-25
and MW-43 - approximately 332 ft

1545 decontaminated equipment and drilling rods

1622 talked to Cliff Kutz still no
analytical results for GP-25
moved drill rig to GP-25

1657 spoke to Cliff Kutz GP-25
contained hits so GP-25 ^{21 KGS} will
be located across from MW 42

1705 off site

100 5/7/10 NB(A) Additional VAP Sampling

KOS (086), MBR (086), Rom' Ulrich (086)

730 On site

50° Rain and thunder storms

w/ lightning strikes at times

930 Break in weather moved to and started at GWGP-25A across from MW-42 21 25

1030 Rain and lighting delay
1105 Continued drilling

drilled to 30' spoke w/ cliff to discuss sample intervals

0-19 sand

19-22.5 clay and silt

22.5-25 sand

25-30 clay

Sample intervals per cliff

3-7 15-19

7-11 21-25

5/7/10 NB(A) Additional Sampling 101

1220 setup and began GWGP-21-VAP 25

DTW 14.51 ground surface

pumped 10 min prior to monitoring - 1230

pumping rate 100 ml / 2 gal collected

1325 turb / collected at 1325

moved and began GWGP-21-VAP 19

DTW 12.42 ground surface

pumped 10 min prior to monitoring - 1335

pumping rate 100 ml - poor water production

1435 turb 35 / collected at 1435

moved and began GWGP-21-VAP 11

DTW 4.69 ground surface

1445 pumped 10 min prior to monitoring - 1445

1545 turb 120 RTU / collected at 1545

pumping rate 140 ml / 3 gal collected

Moved and began GWGP-21-VAP 7

DTW 3.88 ground surface

1550 pumped 10 min prior to monitoring - 1550

pumping rate 140 ml / 3 gal collected

1630 turb / collected at 1630

lightning
1635 Rain and thunder continue / MBR off site

5/10/10 sunny 50°F
 10.2 NBIA Additional VAP sampling
 900 Kevin Schneider (CBSG), Tom Vlach (stems) on site
 918 began to pressure grout GP-21
 930 Mike Holston on site
 finished grouting well GP-21
 1000 began decon of Geoprobe equipment
 1015 Jerry (stems) John (stems) on site
 began unloading equipment
 spoke w/ cliff Vantz about well info
 from GP-24/MW-47
 MW-47
 grout + future seal 17.7 - 19.7
 sand pack 19.7 - 20.7
 screen 20.7 - 23.7
 cement
~~concrete~~ axa at angle 2' depth for pad
 bell'd grout and ~~concrete~~ cement at 2' by
 ball's in line w/ corn field
 place 6" toward the road / 3' either side of well
 After development and additional sand
 pack if needed.

5/10/10 NBIA Additional VAP sampling sunny 60°F 103
 finished drilling at M. K33
 set up and started drilling at
 MW-49
 drilled down to 20' fbg made contact w/
 silty clay spoke w/ cliff Vantz
 who spoke w/ chuck Gaff. were
 told to drill down to 30 fbg
 drilled down to 30 fbg was a
 mix of sand and clay drilled an
 additional 10' to 40 fbg hit silty clay
 at 36.8 fbg
 spoke w/ cliff Vantz - cliff to discuss
 sample intervals w/ chuck Gaff
 inspected MW-39 which was bent
 appears to be folded over at 4.5-5' or
 6" fbg will repair on 5/11/10

5/11/10 Rain 40°F
10:4 NBIA Additional VAP Sampling

730 on site unloaded Geoprobe and
moved HSA rig

805 set up geoprobe at MW-49 will use
to blind drill to smoke intervals to
use for VAP Sampling
for MW-49 VAP Sampling intervals
20-24
27-31

New GP-24 for Chuck and Cliff
root 0 - 17.2
seal 17.2 - 19.2
sand pack 19.2 - 19.7 4" screen #7
screen 19.7 - 23.7

Repaired MW-39 and installed
bathys - well folded over
at 5-6" below grade
installed casing and placed
bentonite around

1015 heavy rain and thunder at times

5/11/10 NBIA Additional VAP Sampling -LOS

1000 finished GWGP-26-VAP 31
purged 10 min prior to monitoring
tube still high at sampling
4.5 gal collected

1110 finished GWGP-26-VAP 24
purged 10 min prior to monitoring
tube high at sampling
4 gal collected

1120 moved to and began drilling at
MW-47
Drilled and installed well
well located 3' south and 1' west of
GP-24
well screen set at 23.7
sand pack

1150 began surveying w/ surge block

1215 off site for lunch
1315 on site

5/11/10
106
N/A Additional VAP sampling

1315-1715 Developed MW-47 for 4 hours

after 20 min well was pumped dry. After approximately an hour well

began to produce more water well was still cloudy at end of

development but cleared up more quickly

trib at 4 hour was 38 MW

2 3/4 water drums collected - 140 gal

1 1/2 soil drum collected

Surged periodically w/ surge block

during development

1730 Drilled off site

1750 EPS off site

5/12/10
N/A Additional VAP sampling 107

730 began finishing MW-47 well

2 1/2 bags sand

1 bag seal

4 bags cement / 1/2 bag bentonite

Wanted 1/2 hour for seal to hydrate

845 Set bulbs and pad

905 moved to MW-41

Spike w/ CITE

grout 0 - 20.0

Seal 20.0 - 22.5

Seal 22.5 - 24.5

Seal 24.5 - 29.5

dilled down to 29.5' and installed

1000 MW-41 and began development

developed 4 hour final trib 24 MW

165 gal collected / surged periodically w/ surge block

1410 added bentonite clay to 19' water 1/2 hour for clay to hydrate

added grout / finished pad

flush mortar

108

5/12/10

NBA Additional Sampling

MW-41

5 gal introduced during installation

3 H₂O drums

2 soil drums

3 1/2 bags sand

1 bag chip

4 bags cement

1600 off site - Drillers

As of 5/12/10

Drum count

8 - H₂O

5 - Soil

1630 KPS off site

5/13/10

NBA Additional Sampling

cloudy 46°F

129

730 Jerry, Tom, KPS onsite

750 finished pad at MW-41

810 stoke w/ cliff about depth for MW-46

grout 0 - 17.5

Soil 17.5 - 19.5

Sand 19.5 - 20

Screen 20 - 25

810 Drillers off site

830 Drillers on site

845 Set up at MW-46

Drilled to 25' filled sand pack to 19.5'

915 Began development at MW-46

Surged periodically w/ surge block

approx every 15 min

1315 final runs 42 NP / 190 gal collected / 4 hrs

- Placed Bentonite chips (soil)

~~KPS added~~ ~~the~~ waited 30 min to hydrate

1 Drum soil

2 bags sand

3 1/4 drums water

1 bag chip

4 bags cement

5/17/10

110

NBIA Additional VAE Sanding
add cement bentonite grout
Decon Augers

1430

Mod to MW-48

Spoke to cliff about MW-48 depth

grout 0-5

seal 5-7

sand 7-9

screen 9-14

drilled down to 14 and filled in
sand pack

1515

Began development

developed 145 min will finish 5/18/10

Burged periodically w/ surge block

1715

off site

111

730

Tom, Jerry, Karin on site

745

Finished development of MW-48

surged periodically w/ surge block

final push 15 min

collected 190 gal / developed 3 hrs

2 bags sand

3/4 bag hole plug

1 bag cement

1 drum soil

3 3/4 drums water

Placed bentonite chips waited 30 min

placed grout and finished pad and ballards

Decon Augers

1029

Spoke w/ cliff about results

for MW-49 wants us to wait for results

then set well and transfer Monday

1115

Drillers off site to get water

112 N/A Additional VAP Sampling

1200 for cliff MW-49

gravel 0 - 18

Gravel 18 - 20

Sand 20 - 20.8

Screen 20.8 - 23.8 3' screen

Sand 23.8 - 25.5

seal 25 - 40

1205 drillers on site

1220 began to back fill boring to 25
w/ bentonite - 3 bags

Set well to 23.8' - 3 bags sand
final pack to 20'

left well well developer on 5/17/10
per cliff OK. left well in closed
by augers so no one can tamper w/

1345 off site

5/17/10 N/A Additional VAP Rain - 1600 11.3

900 on site RBS

915 on site Jerry Hutton, Gary (strains)

930 began development of MW-49

well did not produce much water

continually pumped dry during development
at 2hr in used to pump to remove
water. Surged more than pumped during
development

930-1600 continued to surge ^{purge then test} ~~test~~ recover ~~then~~
^{purge} until 1500 the well began
to produce water at 1gal/min
final test 41 NTU collected 165 gal
developed for 6 1/2 hours
during grouting well lifted
1.5ft. drillers were able to
pound back down to 23.7'

1630 Redeveloped collecting 55 gal
well produced water at 1gal/min
and turb was approx 90 NTU
for 45 min well appears to be fine

1730 finished grouting and setting bollards

114

Second Agency's
Black bladed road
loaded equipment

1845 off site

6/7/10

NBIA GW Sampling

60°F clear

115

915 onsite to sample wells installed
in 5/10 and 9/08 sampling for
cyanide, metals, and UO₂

940 Began collecting DTW

945 MW-41 DTW 4.55

1000 MW-46 DTW 5.08

1009 MW-49 DTW 3.90

1014 MW-47 DTW 6.17

1025 MW-40 DTW 7.11

1030 MW-48 DTW 6.06

1035 MW-42 DTW 7.08

1039 MW-39 DTW 7.30

1053 MW-38 DTW 10.35

1100 MW-37 DTW 12.73

1100 Chris Cox on site discussed project and
Safety Tool Box meeting set up with equipment

1130 Chris Cox offsite for lunch

1138 MW-43 DTW 5.95

1144 MW-28 DTW 7.50

1147 MW-455 DTW 7.40

1149 MW-450 DTW 6.74

116 6/7/10

1200 MW-6S DTW 6.64

1203 MW-6D DTW 5.48

1200 Chris Cox on site

Spoke w/ Cliff Kutz about well sampling
order MW-42, MW-40, MW-33I
order to cut along drain any
order for newer wells

1240 MW-33I DTW 6.77

1242 MW-33S DTW 6.72

1244 MW-44S DTW 6.90

1246 MW-44D DTW 5.34

1250 SG-1 DTW 1.16 debris around gauge

1304 MW-7S DTW 9.69

1307 MW-29 DTW 5.69

1311 MW-32E DTW 7.16

1313 MW-32S DTW 7.02

1325 MW-26 DTW 6.23

1328 MW-30 DTW 5.97

1334 MW-31 DTW 4.89

1337 MW-8S DTW 7.09

1339 MW-8I DTW 5.95

6/7/10

117

1342 MW-36 DTW 4.65

1355 MW-25 DTW 6.90

1400 MW-9S DTW 6.30

1425 MW-5S DTW 7.22

1426 MW-5D DTW 7.24

1429 MW-4S DTW 7.89

1438 PZ-5 DTW 6.23

1435 spoke w/ Chuck Buckley to
let him know we will be on site

1448 MW-27 DTW 7.54

1454 PZ-7S DTW 6.99

1456 PZ-7D DTW 6.89

Found PZ-6P/S

PZ-6D Total Depth 59.48 DTW 4.26

PZ-6S Total Depth 11.88 DTW 4.25

entire flush mount fill with and
nest

Unable to read SG-2 due to shrubs
in the way

118

6/7/10

1225-1300 Chris Cox sampled MW-42
 collected sample at 1440
 MS/MSD collected turb 107 at sampling
 38 at finish

6/8/10

119

730 on site to continue GW sampling

730 Chris Cox set up at MW-40 - Rental flow cell

745 Kevin Schneider set up at MW-39 - our flow cell

calibrated equipment for pH, Con, ORP,

900 Chris Cox collected sample from MW-40
 turb 28

940 KBS collected sample from MW-39

turb 9

Chris Cox set up at MW-49 - Rental flow cell

1040 KBS set up at MW-48 - our flow cell

1135 KBS collected sample from MW-48

turb 6

1200 Chris collected sample from MW-49

turb 45

1215 Chris off site

1245 Chris on site

120

6/8/10

1250 KPS set up at MW-47 - our flow cell

1405 KPS collected MW-47

far out of tubing waiting for
shipment to come to WW plant

1500 Pick up / cleaned equipment
added reflectors to wellheads

1530 off site

6/9/10

121

730 arrived on site to collect 4
additional / sediment samples at
mid points between SD-35 and SD-36
SD-36 and SD-37 SD-37 and SD-38
SD-38 and SD-39

6

830 found location between SD-35 and
SD-36 using GPS accurate
within 7ft called location
SD-40

dark brown, muck, leaf litter
organics

sediment 2" thick 6" water

(b) (6)

found location between SD-36 and SD-37
using GPS accurate 7.5ft called
location SD-41

(b) (6)

122

sediment 6" thick - 6" water
dark brown, muck, little silt and
clay, leaf litter, organics
900 collected at 900

found location between SD-37 and
SD-38 using GPS location
accurate within 7.5 ft called
* SD-42 also collected SD-DUP-08
N
W

sediment 4" thick - 6" water
dark brown, muck, little silt and
clay, organics
920 collected at 920

found location between SD-38 and
SD-39 using GPS location accurate
within 15 ft call SD-43
N
W

sediment 3" thick - 6" water
dark brown, muck, little silt and clay
leaf litter, grass, organics
little sand
940 collected at 940

6/9/10

123

calibrated flow cells
and setup at MW-41 (cox)
MW-46 (KBS)

KBS collected sample from MW-46
trib

Chris Cox collected sample from MW-41
trib
decayed and dumped water

KBS setup at MW-43

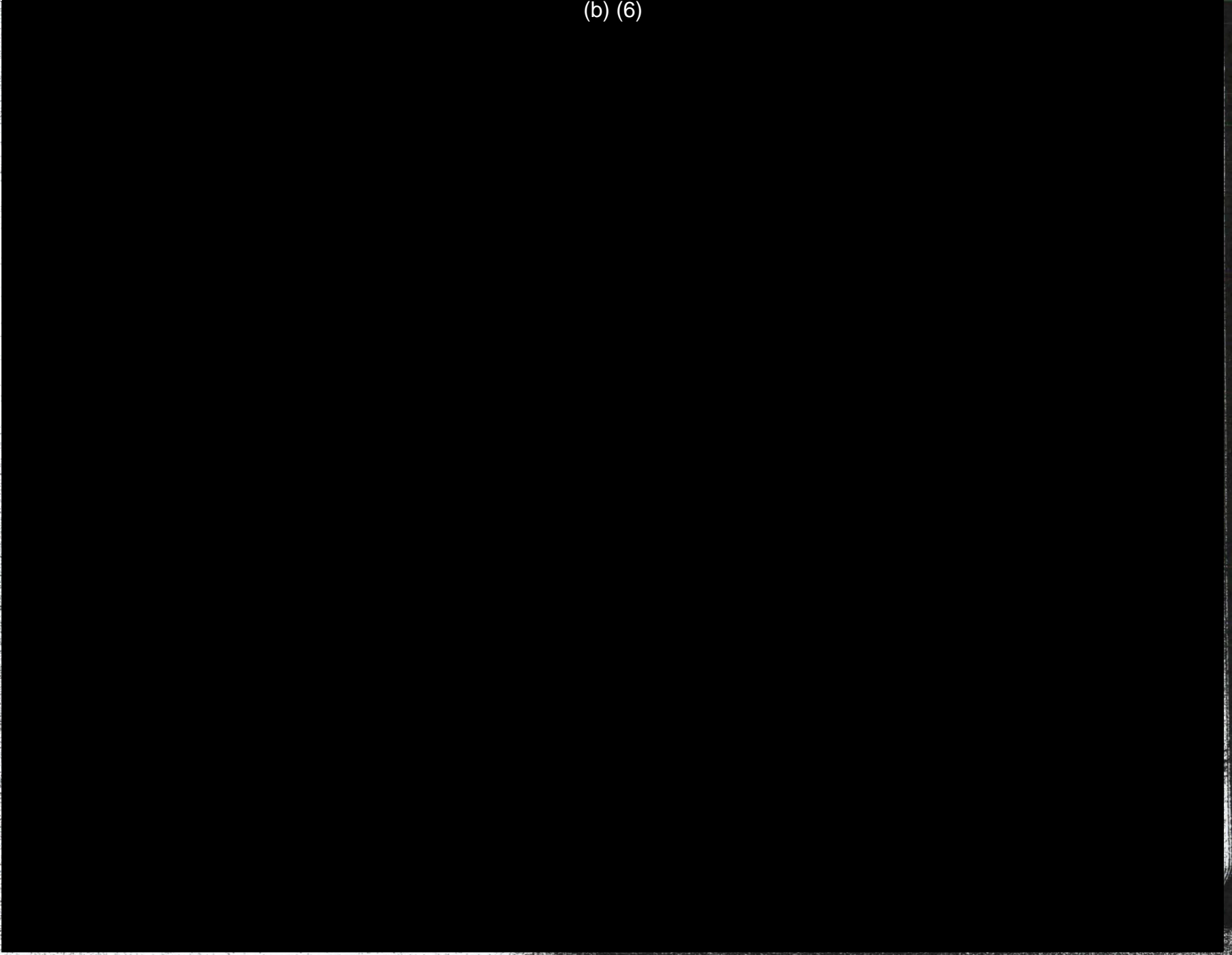
cox setup at MW-45s

* GW-DUP-01 collected at MW-45s

GW-EB-01 collected on KBS pump
Meijer distilled water

cox collected sample from MW-45s
setup not sampled MW-45D

(b) (6)



(b) (6)

6/10/10

127

830 onsite to check pH level at MW-
MW-455, MW-450
also adding reflectors to Bollards

MW-	pH
MW-455	pH
MW-450	pH

930 off site

Appendix B
Boring Logs



O'BRIEN & GERE

BORING LOG

WELL NO. GP-21/MW-48

PROJECT: NBIA GW Delineation Study
 CLIENT: NBIA OU1 PRP Group
 INSPECTOR: MBR / KBS

SHEET 1 OF 2

JOB NO. 12716 / 41845 #4

DRILLING CONTRACTOR: Stearns Drilling Co.

GROUND ELEV. 905.07

DRILLER: Tom Ulrich

DATUM

PURPOSE:

DATE STARTED 5/7/2010

DRILLING METHOD: Direct Push, HSA

DATE FINISHED 5/7/2010

DRILL RIG TYPE: Geoprobe

	SAMPLE	CORE	CASING
TYPE	SS	---	---
DIA.	2.0"	2.0"	---

DEPTH (ft)	Sample Type Number	Blows/6" (N Value)	Penetration/ Recovery	MATERIAL DESCRIPTION	Graphic Log	USCS Symbol	Stratum Change	Field Testing PID (ppm)	Well Graphic	REMARKS
				dark brown, moist, sandy SILT, little roots		SP		0		
2	SS-1		5.0' / 3.0'	903.7 903.5 903.2 medium brown, moist, silty SAND, little clay, little gray silt	1.4 1.6 1.9	SP CL		0		
4				dark grayish brown, moist, sandy CLAY, trace gravel		SPG		0		
				medium light brown, moist, C-F gravelly SAND, little clay and silt				0		
				900.6 medium light gray, wet, fine SAND	4.5			0		
6						SP		0		
8	SS-2		5.0' / 4.0'					0		
10				895.6 medium light gray, wet, C-F SAND and GRAVEL, sub-rounded to sub-angular	9.5	SPG		0		
12	SS-3		5.0' / 4.5'					0		
14				medium light gray, wet, sandy GRAVEL, some coarse gravel, sub-rounded to sub-angular, sand and gravel to 15'		SPG		0		
16				medium light gray, wet, sandy GRAVEL, sub-rounded to sub-angular		SPG		0		
18	SS-4		5.0' / 4.0'	medium light gray, wet, SAND and GRAVEL		SPG		0		
20				886.1 grayish brown, wet, silty, sandy CLAY, little small gravel, non-plastic	19.0	CL		0		

Notes: VAP sample from 3' to 7'; VAP sample from 7' to 11'; VAP sample from 15' to 19'; VAP sample from 21' to 25'

Report Name: NEW OBG BORING LOG Data Template: OBG GINT STD US.GDT

(Continued Next Page)



OBRIEN & GERE

BORING LOG

WELL NO. GP-21/MW-48

PROJECT: NBIA GW Delineation Study
CLIENT: NBIA OU1 PRP Group
INSPECTOR: MBR / KBS

SHEET 2 OF 2

JOB NO. 12716 / 41845 #4

Borehole Log											
DEPTH (ft)	Sample Type Number	Blows/6" (N Value)	Penetration/ Recovery	MATERIAL DESCRIPTION		Graphic Log	USCS Symbol	Stratum Change	Field Testing PID (ppm)	Well Graphic	REMARKS
22	SS-5		5.0'/ 5.0'	882.7	grayish brown, wet, silty, sandy CLAY, little small gravel, non-plastic (continued)		CL		0		
					grayish brown, wet, sandy SILT		CL				
					grayish brown, wet, sandy, silty CLAY		CL				
					grayish brown, wet, fine silty SAND		CL				
24					grayish brown, wet, C-F SAND, some gravel		SP				
26				880.1	grayish brown, wet, C-F SAND and GRAVEL, sub-rounded to sub-angular		SPG				
					grayish brown, wet, C-F SAND, some gravel, little clay		SP				
28	SS-6		5.0'/ 4.5'		grayish brown, moist, silty CLAY, little gravel, trace coarse gravel, pieces of shale at 27', piece of granite at 29.6'		CL		0		
30				875.1	End of Borehole at 30.0'.				0		
32											
34											
36											
38											
40											
42											
44											

Report Name: NEW OBG BORING LOG Data Template: OBG GINT STD US.GDT



O'BRIEN & GERE

BORING LOG

WELL NO. GP-22/MW-46

PROJECT: NBIA GW Delineation Study
 CLIENT: NBIA OU1 PRP Group
 INSPECTOR: MBR / KBS

SHEET 1 OF 2

JOB NO. 12716 / 41845 #4

DRILLING CONTRACTOR: Stearns Drilling Co.

GROUND ELEV. 908.86

DRILLER: Tom Ulrich

PURPOSE:

DATUM

DRILLING METHOD: Direct Push, HSA

	SAMPLE	CORE	CASING
TYPE	SS	---	---
DIA.	2.0"	2.0"	---

DATE STARTED 5/6/2010

DRILL RIG TYPE: Geoprobe

DATE FINISHED 5/6/2010

DEPTH (ft)	Sample Type Number	Blows/6" (N Value)	Penetration/ Recovery	MATERIAL DESCRIPTION	Graphic Log	USCS Symbol	Stratum Change	Field Testing PID (ppm)	Well Graphic	REMARKS
2	SS-1		5.0'/ 3.0'	dark brown, moist, silty SAND 907.9	1.0	SM		0		
4				medium brown to orangish brown, moist, M-F SAND, trace gravel and coarse sand 904.9	4.0	SP		0		
6				grayish brown, moist, C-F SAND, little to trace gravel 903.9	5.0	SP		0		
8	SS-2		5.0'/ 3.3'	medium brown, moist, M-F SAND, little to trace silt and clay, trace gravel 902.9	6.0	SP		0		
10				grayish brown, moist, C-F SAND, trace to little gravel, wet at 7'		SP		0		
12	SS-3		5.0'/ 3.0'	same as above, some gravel, little coarse gravel, sub-rounded to sub-angular		SP		0		
14				grayish brown, wet, SAND and GRAVEL, sub-rounded to sub-angular		SPG		0		
16				grayish brown, wet, C-F SAND, little gravel, sub-rounded		SP		0		
18	SS-4		5.0'/ 4.5'	grayish brown, wet, coarse SAND and GRAVEL, sub-rounded to sub-angular		SPG		0		
20				grayish brown, wet C-F SAND		SP		0		
				grayish brown, wet, C-F SAND and GRAVEL, sub-rounded to sub-angular		SPG		0		
				orangish brown to orange, wet, SAND and GRAVEL, sub-round to sub-angular 891.3	17.6	SPG		0		
				grades to grayish brown, wet, C-F SAND, little to some gravel 890.3	18.6	SP		0		
				medium light gray, moist, sandy CLAY, little to trace gravel 888.9	20.0	CL				

Notes: VAP sample from 7' to 11'; VAP sample from 13' to 17'; VAP sample from 21' to 25'

Report Name: NEW OBG BORING LOG Data Template: OBG GINT STD US.GDT

(Continued Next Page)

**OBRIEN & GERE****BORING LOG****WELL NO. GP-22/MW-46****PROJECT:** NBIA GW Delineation Study
CLIENT: NBIA OU1 PRP Group
INSPECTOR: MBR / KBS

SHEET 2 OF 2

JOB NO. 12716 / 41845 #4

DEPTH (ft)	Sample Type Number	Blows/ft (N Value)	Penetration/ Recovery	MATERIAL DESCRIPTION	Graphic Log	USCS Symbol	Stratum Change	Field Testing PID (ppm)	Well Graphic	REMARKS
22	SS-5	5.0/ 4.5'		grayish brown, moist to wet, M-F SAND, trace gravel		SP		0		
24				grayish brown, wet, M-F SAND, little coarse gravel, less gravel with depth, little coarse sand with depth				0		
26	SS-6	5.0/ 3.5'		grayish brown, wet, silty CLAY, little sand		CL		0		
28				grayish brown, wet, sandy SILT, little clay, trace fine gravel				0		
30				End of Borehole at 30.0'.				0		
32										
34										
36										
38										
40										
42										
44										



OBRIEN & GERE

BORING LOG

WELL NO. GP-23/MW-41

PROJECT: NBIA GW Delineation Study
 CLIENT: NBIA OU1 PRP Group
 INSPECTOR: MBR / KBS

SHEET 1 OF 2

JOB NO. 12716 / 41845 #4

DRILLING CONTRACTOR: Stearns Drilling Co.

GROUND ELEV. 908.46

DRILLER: Tom Ulrich

PURPOSE:

DRILLING METHOD: Direct Push, HSA

DRILL RIG TYPE: Geoprobe

	SAMPLE	CORE	CASING
TYPE	SS	---	---
DIA.	2.0"	2.0"	---

DATUM

DATE STARTED 5/5/2010

DATE FINISHED 5/5/2010

DEPTH (ft)	Sample Type Number	Blows/6" (N Value)	Penetration/ Recovery	MATERIAL DESCRIPTION	Graphic Log	USCS Symbol	Stratum Change	Field Testing PID (ppm)	Well Graphic	REMARKS
2	SS-1		5.0'/ 3.0'	907.9 dark brown, moist, sandy SILT, trace gravel, 2-7" more medium brown color medium brown, moist, M-F SAND, trace coarse sand and trace gravel	0.6	SM		0		
4				904.9 medium brown, moist, sandy CLAY, trace gravel, medium plastic, medium stiff 904.4 light brown, moist, C-F SAND, trace gravel	3.6 4.1	CL		0		
6				903.5 medium brown, moist, M-F SAND, little clay, trace gravel	5.0	SP		0		
8	SS-2		5.0'/ 3.5'	902.5 medium brown, moist, clayey SAND, trace gravel 902.2 light brown, moist, M-F SAND, trace gravel brown, moist, sandy SILT, little gravel light brown, wet, C-F SAND, some gravel, wet at 6.9' light brown, wet, M-F SAND, little coarse sand	6.0 6.3	SP SM SP		0		
10						SP		0		
12	SS-3		5.0'/ 4.5'	light brown, wet, C-F SAND, some gravel		SP		0		
14				light brown, wet, C-F SAND and GRAVEL, little coarse gravel, little organish brown sand at 13.8' and 14.5'		SPG		0		
16				893.5 grayish brown, wet, C-F SAND, sub-angular	15.0			0		
18	SS-4		5.0'/ 5.0'	grayish brown, wet, C-F SAND, some gravel		SP		0		
20				889.5 medium light gray, moist to wet, silty CLAY, trace gravel, plastic, medium stiff 888.5	19.0 20.0	CL		0		

Notes: VAP sample from 7' to 11'; VAP sample from 15' to 19'; VAP sample from 20' to 24'; VAP sample from 25.5' to 29.5'; VAP sample from 32' to 36'

Report Name: NEW OBG BORING LOG Data Template: OBG GINT STD US.GDT

(Continued Next Page)



O'BRIEN & GERE













BORING LOG

WELL NO. GP-23/MW-41

PROJECT: NBIA GW Delineation Study
 CLIENT: NBIA OU1 PRP Group
 INSPECTOR: MBR / KBS

SHEET 2 OF 2

JOB NO. 12716 / 41845 #4

DEPTH (ft)	Sample Type Number	Blows/6" (N Value)	Penetration/ Recovery	MATERIAL DESCRIPTION	Graphic Log	USCS Symbol	Stratum Change	Field Testing PID (ppm)	Well Graphic	REMARKS
22	SS-5	5.0/ 5.0'		grayish brown, wet, M-F SAND, some coarse sand		SP		0		
				grayish brown, wet, clayey SAND, little gravel		SP				
				grayish brown, wet, C-F SAND, sub-angular, trace coarse gravel at 23'		SP		0		
24				grayish brown, wet, C-F SAND, some gravel, sub-angular, less gravel 24.5' to 25'		SP		0		
26	SS-6	5.0/ 5.0'		grayish brown, moist to wet, M-F SAND		SP		0		
28				same as above, little gravel, some coarse		SP		0		
30				grayish brown, moist, silty SAND, little clay, glacial till		SP		0		
				grayish brown, wet, fine SAND		SP		0		
32	SS-7	3.0/ 3.0'		grayish brown, wet, clayey SAND, trace coarse sand and gravel		SP		0		
34				grayish brown, wet, M-F SAND, mainly fine sand		SP		0		
				grayish brown, wet, clayey SAND		SP		0		
				grayish brown, wet, M-F SAND, trace to little gravel		SP		0		
36	SS-8	3.0/ 3.0'						0		
								0		
								0		
								0		
38	SS-9	4.0/ 4.0'						0		
								0		
								0		
								0		
40				872.2 36.3 grayish brown, moist to wet, clayey SILT, little sand				0		
								0		
								0		
								0		
42				868.5 40.0 End of Borehole at 40.0'.				0		
44										

Report Name: NEW OBG BORING LOG Data Template: OBG GINT STD US.GDT



OBRIEN & GERE

BORING LOG

WELL NO. GP-24/MW-47

PROJECT: NBIA GW Delineation Study
 CLIENT: NBIA OU1 PRP Group
 INSPECTOR: MBR / KBS

SHEET 1 OF 2

JOB NO. 12716 / 41845 #4

DRILLING CONTRACTOR: Stearns Drilling Co.

GROUND ELEV. 905.54

DRILLER: Tom Ulrich

PURPOSE:

DATUM

DRILLING METHOD: Direct Push, HSA

	SAMPLE	CORE	CASING
TYPE	SS	---	---
DIA.	2.0"	2.0"	---

DATE STARTED 5/4/2010

DRILL RIG TYPE: Geoprobe

DATE FINISHED 5/4/2010

DEPTH (ft)	Sample Type Number	Blows/6" (N Value)	Penetration/ Recovery	MATERIAL DESCRIPTION	Graphic Log	USCS Symbol	Stratum Change	Field Testing PID (ppm)	Well Graphic	REMARKS
2	SS-1		5.0'/ 2.5'	dark brown, moist, sandy SILT, trace gravel, little roots 0 to 2"		SM		0		
4				medium brown, moist, M-F SAND, little C-F sand, little clay, trace gravel		SP		0		
6				medium brown, wet, C-F SAND, little gravel, trace silt and clay		SP		0		
8	SS-2		5.0'/ 3.5'	medium brown, wet, C-F SAND, some silt, little gravel, sub-rounded to sub-angular		SP		0		
10				grayish brown, wet, C-F SAND and GRAVEL, trace silt and clay, sub-rounded to sub-angular		SPG		0		
12	SS-3		5.0'/ 5.0'	grayish brown, moist, silty CLAY, trace gravel, plastic, medium stiff		CL		0		
14				grayish brown, wet, sandy CLAY, little silt, trace gravel, soft		CL		0		
16				grayish brown, moist, sandy CLAY, little silt, trace gravel, plastic, medium soft, coal pieces at 15'		CL		0		
18	SS-4		5.0'/ 3.5'	grayish brown, moist, sandy CLAY, little gravel, gray mottling at 17', stiff		CL		0		
20				grayish brown, moist, clayey SAND, trace gravel, trace coarse gravel at 20'		SP		0		

Notes: VAP sample from 3' to 7'; VAP sample from 7' to 11'; VAP sample from 20' to 24'

(Continued Next Page)

Report Name: NEW OBG BORING LOG Data Template: OBG GINT STD US.GDT



O'BRIEN & GERE

BORING LOG

WELL NO. GP-24/MW-47

PROJECT: NBIA GW Delineation Study
CLIENT: NBIA OU1 PRP Group
INSPECTOR: MBR / KBS

SHEET 2 OF 2

JOB NO. 12716 / 41845 #4

DEPTH (ft)	Sample Type Number	Blows/6" (N Value)	Penetration/ Recovery	MATERIAL DESCRIPTION	Graphic Log	USCS Symbol	Stratum Change	Field Testing PID (ppm)	Well Graphic	REMARKS
22	SS-5		5.0' / 5.0'	medium brown, wet, C-F SAND, sub-rounded to sub-angular		SP		0		
24				medium brown, wet, C-F SAND and GRAVEL, sub-rounded to sub-angular		SPG		0		
26	SS-6		2.5' / 2.5'	grayish brown, moist, sandy SILT, little clay, trace gravel, glacial till		CL		0		
28				End of Borehole at 27.5'.				0		
30										
32										
34										
36										
38										
40										
42										
44										



OBRIEN & GERE

BORING LOG

BORING NO. GP-25

PROJECT: NBIA GW Delineation Study
 CLIENT: NBIA OU1 PRP Group
 INSPECTOR: MBR / KBS

SHEET 1 OF 2

JOB NO. 12716 / 41845 #4

DRILLING CONTRACTOR: Stearns Drilling Co.

GROUND ELEV.

DRILLER: Tom Ulrich

PURPOSE:

	SAMPLE	CORE	CASING
TYPE	SS	---	---
DIA.	2.0"	2.0"	---

DATUM

DRILLING METHOD: Direct Push, HSA

DATE STARTED 5/3/2010

DRILL RIG TYPE: Geoprobe

DATE FINISHED 5/3/2010

DEPTH (ft)	Sample Type Number	Blows/6" (N Value)	Penetration/ Recovery	MATERIAL DESCRIPTION	Graphic Log	USCS Symbol	Stratum Change	Field Testing PID (ppm)	REMARKS
2	SS-1	5.0'/ 2.5'	5.0'/ 2.5'	dark brown, moist, clayey SILT, little to some sand, trace gravel, roots 0 to 2", trace roots to 5"	1.3	SM		1.6	
				medium brown, moist, C-F SAND, little clay, trace gravel, predominately M-F sand	2.0	SP		1.5	
4				grayish brown, moist, C-F SAND, trace silt and clay, sub-rounded to sub-angular, wet at 4'		SP		2.2	
6	SS-2	5.0'/ 2.5'	5.0'/ 2.5'	grayish brown, wet, SAND and GRAVEL, sub-rounded to sub-angular, trace silt and clay	6.0	SPG		1.1	
8								2	
10	SS-3	5.0'/ 5.0'	5.0'/ 5.0'	grayish brown, wet, C-F SAND, sub-rounded to sub-angular, little angular	10.0	SP		2.4	
12				same as above, sand and gravel		SP		0	
14				grayish brown, wet, C-F SAND, sub-rounded to sub-angular		SP		1.5	
16				grayish brown, wet, M-F SAND, little coarse sand	15.5	SP		0	
18	SS-4	5.0'/ 5.0'	5.0'/ 5.0'	grayish brown, wet, C-F SAND and GRAVEL, predominately coarse sand, sub-rounded to sub-angular		SPG		0	
								0	
20				medium brown, wet, M-F SAND, pieces of coal	19.0	SP			
				medium brown, wet, silty CLAY, trace gravel, trace sand,	19.5	CL			
					20.0				

Notes: VAP sample from 3.5' to 7.5'; VAP sample from 7.5' to 11.5'; VAP sample from 15.5' to 19.5'; VAP sample from 23.5' to 27.5'

Report Name: NEW OBG BORING LOG Data Template: OBG GINT STD US.GDT

(Continued Next Page)

**OBRIEN & GERE****BORING LOG****BORING NO. GP-25****PROJECT:** NBIA GW Delination Study
CLIENT: NBIA OU1 PRP Group
INSPECTOR: MBR / KBS

SHEET 2 OF 2

JOB NO. 12716 / 41845 #4

DEPTH (ft)	Sample Type Number	Blows/ft (N Value)	Penetration/ Recovery	MATERIAL DESCRIPTION	Graphic Log	USCS Symbol	Stratum Change	Field Testing PID (ppm)	REMARKS
22	SS-5	5.0/ 5.0'		stiff medium brown, wet, M-F SAND, little clay, trace to little gravel	21.0	SP		0	
				medium brown, wet, sandy SILT, little clay		SM		0	
24				medium brown, wet, silty SAND, little clay	23.5	SM			
	SS-6	5.0/ 5.0'		medium brown, wet, M-F SAND, predominately fine sand		SP		0	
26				medium brown, wet, M-F SAND, little silt and clay		SP		0.2	
28				medium brown, moist, silty CLAY, trace gravel, stiff, non-plastic	27.5	CL		0.1	
30				End of Borehole at 30.0'.	30.0			0	
32									
34									
36									
38									
40									
42									
44									



OBRIEN & GERE

BORING LOG

WELL NO. GP-26/MW-49

PROJECT: NBIA GW Delineation Study
 CLIENT: NBIA OU1 PRP Group
 INSPECTOR: MBR / KBS

SHEET 1 OF 2

JOB NO. 12716 / 41845 #4

DRILLING CONTRACTOR: Stearns Drilling Co.

GROUND ELEV. 904.9

DRILLER: Jerry Huntoon

PURPOSE:

DATUM

DRILLING METHOD: Direct Push, HSA

	SAMPLE	CORE	CASING
TYPE	SS	---	---
DIA.	---	---	---

DATE STARTED 5/10/2010

DRILL RIG TYPE: HSA

DATE FINISHED 5/10/2010

DEPTH (ft)	Sample Type Number	Blows/6" (N Value)	Penetration/ Recovery	MATERIAL DESCRIPTION	Graphic Log	USCS Symbol	Stratum Change	Field Testing PID (ppm)	Well Graphic	REMARKS
2	SS-1	3-3-3-4 0	2.0/ 2.0'	dark brown, moist, silty SAND, some roots		SM		0		
				903.4 1.5						
				902.9		CL				
4	SS-2	5-6-7-6 0	2.0/ 2.0'	grayish brown, moist, sandy CLAY, little gravel		CL		0		
				medium brown, F-M SAND, little gravel, moist at 3', wet at 3.5'		SP				
				900.9				0		
6	SS-3	5-8-9-10 0	2.0/ 1.5'	medium brown, wet, C-F SAND and GRAVEL, little coarse gravel, trace silt and clay		SPG				
				898.9				0		
8	SS-4	5-12-12-14 0	2.0/ 1.5'	medium brown, wet, C-F SAND, some gravel, sub-rounded to sub-angular						
						SP		0		
10	SS-5	5-11-10-5 0	2.0/ 1.0'							
								0		
12	SS-6	2-2-2-4 0	2.0/ 1.0'	grayish brown, moist, silty CLAY, trace coarse sand		CL				
								0		
14	SS-7	2-2-2-5 0	2.0/ 1.5'	same as above, trace gravel		CL				
								0		
16	SS-8	1-2-5-5 0	2.0/ 2.0'	same as above, little sand at 15.5'		CL				
				grayish brown, moist to wet, sandy CLAY, soft, plastic				0		
18	SS-9	1-1-1-2 0	2.0/ 1.3'							
						CL		0		
20	SS-10	2-2-14-19 0	2.0/ 0.5'							
				884.9						

Notes:

Report Name: NEW OBG BORING LOG Data Template: OBG GINT STD US.GDT

(Continued Next Page)



O'BRIEN & GERE

BORING LOG

WELL NO. GP-26/MW-49

PROJECT: NBIA GW Delineation Study
 CLIENT: NBIA OU1 PRP Group
 INSPECTOR: MBR / KBS

SHEET 2 OF 2

JOB NO. 12716 / 41845 #4

DEPTH (ft)	Sample Type Number	Blows/s (N Value)	Penetration/ Recovery	MATERIAL DESCRIPTION	Graphic Log	USCS Symbol	Stratum Change	Field Testing PID (ppm)	Well Graphic	REMARKS
22	SS-11	5-6-11-15 ()	2.0/ 2.0'	grayish brown, wet, fine sand, grades to F-C sand grayish brown, wet, F-C sand, little gravel		SP		0		
24	SS-12	4-4-5-5 ()	2.0/ 1.5'	saa, some gravel		SP		0		
24				881.1	23.8	SP				
26	SS-13	3-10-16-13 ()	2.0/ 1.5'	grayish brown, wet to moist, silty CLAY, trace fine gravel		CL		0		
26				879.4	25.5					
26				879.2	25.7	SPG				
26				878.9	26.0	CL		0		
26				grayish brown, wet, SAND and GRAVEL grayish brown, moist, silty CLAY, trace fine gravel grayish brown, moist, SILT, some fine sand		SM				
28	SS-14	3-9-12-10 ()	2.0/ 1.0'			SM		0		
28				876.9	28.0	SM				
28				same as above, clayey silt		SP		0		
30	SS-15	3-4-7-10 ()	2.0/ 2.0'	grayish brown, wet, fine to medium fine SAND, trace to little silt and clay		SP				
30				trace coarse gravel and little clay grayish brown, wet, M-F SAND, little silt and clay		SP		0		
30				873.9	31.0	SP				
32	SS-16	4-7-15-14 ()	2.0/ 2.0'	grayish brown, moist to wet, silty CLAY, stiff		CL				
32				grayish brown, wet, very fine sand, trace to little silt and clay		SM		0		
34	SS-17	16-10-14-18 ()	2.0/ 2.0'	grayish brown, wet, M-F SAND, trace silt and clay grayish brown, wet, clayey silt grayish brown, wet, M-F SAND, little silt and clay, trace gravel		SM		0		
34						SM				
36	SS-18	18-19-24-17 ()	2.0/ 2.0'	grayish brown, moist to wet, clayey SILT, grading to silty clay		CL		0		
36				grayish brown, wet, clayey SAND, trace coarse gravel, sub-rounded to sub-angular, grades to fine sand		CL				
38	SS-19	17-23-34-31 ()	2.0/ 2.0'	grayish brown, moist, silty CLAY, trace sand and gravel, stiff, 1" gravel seam at 37.5'		CL		0		
38						CL				
40	SS-20	15-27-35-37 ()	2.0/ 2.0'							
40				864.9	40.0					
40				End of Borehole at 40.0'.						
42										
44										

Appendix C

Groundwater Sampling Logs

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/7/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel _____

Weather

Well #

Evacuation Method

Sampling Method

Rain 62°F
GWGP-21-VAP 7
Pentathic pump
Low-flow

Well Information:

Depth of Well * _____ ft.
 Depth to Water * 3.88 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling

Did well go dry?

3 gal.(s)
No

* Measurements taken from

☐ Well Casing☐ Protective Casing☐ (Other, Specify) _____

Instrument Calibration:

Calibrated within Range

Conductivity yes
 DO AS
 pH: 7 10.5 4 or 10
 ORP AS

Turbidity: zero 200 or 225

purged 10 min prior to monitoring

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
<u>1600</u>	initial <u>140</u>	initial _____	initial <u>13.00</u>	initial <u>564</u>	initial <u>4.34</u>	initial <u>7.37</u>	initial <u>-59.7</u>	initial <u>121</u>
<u>1605</u>	_____	_____	<u>12.94</u>	<u>567</u>	<u>3.11</u>	<u>7.24</u>	<u>-54.4</u>	<u>66</u>
<u>1610</u>	_____	_____	<u>12.88</u>	<u>568</u>	<u>2.31</u>	<u>7.18</u>	<u>-48.4</u>	<u>37</u>
<u>1615</u>	_____	_____	<u>12.95</u>	<u>569</u>	<u>2.05</u>	<u>7.17</u>	<u>-47.6</u>	<u>25</u>
<u>1620</u>	_____	_____	<u>12.88</u>	<u>571</u>	<u>1.77</u>	<u>7.15</u>	<u>-47.5</u>	<u>28</u>
<u>1625</u>	_____	_____	<u>12.74</u>	<u>569</u>	<u>1.69</u>	<u>7.12</u>	<u>-47.4</u>	<u>27</u>
<u>1630</u>	_____	_____	<u>12.72</u>	<u>569</u>	<u>1.57</u>	<u>7.10</u>	<u>-47.1</u>	<u>26</u>
_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____

Water Sample:

Time Collected

1630

Physical Appearance at Start

Physical Appearance at Sampling

Color

Odor

Turbidity

Sheen/Free Product

Slightly cloudy
121
—

Color

Odor

Turbidity

Sheen/Free Product

clear
—
25
—

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/7/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel _____

Weather clear 65°F
 Well # GWGP-21-VAP11
 Evacuation Method Peristaltic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * _____ ft.
 Depth to Water * 4.69 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling 3 gal.(s)Did well go dry? no

* Measurements taken from

☐ Well Casing☐ Protective Casing

(Other, Specify) _____

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes 4 or 10
 ORP Yes

Turbidity: zero 200 or 225

purged 10 min prior to monitoring to remove fines

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
1455	initial 140	initial	initial 12.31	initial 546	initial 5.87	initial 7.52	initial -115.4	initial 76
1500			12.16	592	4.98	7.25	-106.7	49
1505			12.62	549	2.03	7.23	-106.6	58
1510			12.86	544	0.46	7.18	-114.3	62
1515			12.32	536	0.13	7.19	-128.9	225
1520			12.28	534	0.04	7.17	-132.5	802
1525			12.47	636	0.06	7.18	-133.0	309
1530			12.35	535	0.06	7.18	-132.8	251
1535			12.24	534	0.07	7.15	-130.3	150
1540			12.11	531	0.11	7.15	-130.1	136
1545			12.01	530	0.11	7.14	-129.8	120

Water Sample:

Time Collected 1545

Physical Appearance at Start

Color clear
 Odor no
 Turbidity no
 Sheen/Free Product _____

Physical Appearance at Sampling

Color slightly clear
 Odor no
 Turbidity no
 Sheen/Free Product _____

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/7/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel _____

Weather Clear 63°F
 Well # GW6P-21-VAP19
 Evacuation Method Peristaltic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * _____ ft.
 Depth to Water * 12.42 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling _____ gal.(s)

Did well go dry? No

(Other, Specify) _____

* Measurements taken from ☐ Well Casing☐ Protective Casing☐ (Other, Specify) _____

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes 4 or 10
 ORP Yes

Turbidity: zero Yes 200 or 225

purged 10 min prior to monitoring to remove fines

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
1345	initial 160	initial	initial 15.18	initial 585	initial 6.94	initial 7.51	initial -124.9	initial 250
1350			14.86	579	5.98	7.49	-137.5	213
1355			14.77	576	5.15	7.48	-148.1	190
1400			14.22	569	5.14	7.31	-141.4	145
1405			14.23	568	6.16	7.24	-134.9	91
1410			14.35	569	6.62	7.23	-135.4	57
1415			14.50	571	6.73	7.23	-133.7	45
1420			14.42	570	6.97	7.22	-132.2	42
1425			14.35	568	7.14	7.19	-132.4	36
1430			14.31	567	7.16	7.18	-131.1	35
1435	↓		14.26	566	7.22	7.17	-130.0	35

Water Sample:

Time Collected 1435

Physical Appearance at Start

Color Slightly cloudy
 Odor _____
 Turbidity high
 Sheen/Free Product _____

Physical Appearance at Sampling

Color clear
 Odor _____
 Turbidity low
 Sheen/Free Product _____

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

Poor water production

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/7/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel _____

Weather Clear 60°F
 Well # GWGP-21-VAP 25
 Evacuation Method Peristaltic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * _____ ft.
 Depth to Water * 14.51 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling

2 gal.(s)

Did well go dry?

No

(Other, Specify) _____

* Measurements taken from

☐ Well Casing☐ Protective Casing☐

Instrument Calibration:

Calibrated within Range

Conductivity 7.5
 DO 4.5
 pH: 7 4.5 4 or 10
 ORP 4.5

Turbidity: zero 200 or 225

purged 10 min prior to monitoring to remove fines

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
<u>1240</u>	initial <u>100</u>	initial _____	initial <u>18.09</u>	initial <u>93</u>	initial <u>10.92</u>	initial <u>5.83</u>	initial <u>256.1</u>	initial <u>890</u>
<u>1245</u>	_____	_____	<u>13.74</u>	<u>567</u>	<u>3.75</u>	<u>6.77</u>	<u>-158.6</u>	<u>810</u>
<u>1250</u>	_____	_____	<u>13.57</u>	<u>559</u>	<u>1.02</u>	<u>6.86</u>	<u>-181.3</u>	<u>445</u>
<u>1255</u>	_____	_____	<u>13.42</u>	<u>558</u>	<u>0.37</u>	<u>6.97</u>	<u>-195.1</u>	<u>194</u>
<u>1300</u>	_____	_____	<u>13.55</u>	<u>560</u>	<u>0.21</u>	<u>7.08</u>	<u>-202.7</u>	<u>102</u>
<u>1305</u>	_____	_____	<u>14.00</u>	<u>564</u>	<u>0.17</u>	<u>7.21</u>	<u>-206.9</u>	<u>59</u>
<u>1310</u>	_____	_____	<u>14.40</u>	<u>569</u>	<u>0.14</u>	<u>7.26</u>	<u>-202.7</u>	<u>44</u>
<u>1315</u>	_____	_____	<u>14.67</u>	<u>573</u>	<u>0.14</u>	<u>7.30</u>	<u>-189.1</u>	<u>40</u>
<u>1320</u>	_____	_____	<u>14.78</u>	<u>572</u>	<u>0.13</u>	<u>7.33</u>	<u>-182.5</u>	<u>42</u>
<u>1325</u>	<u>↓</u>	_____	<u>14.86</u>	<u>572</u>	<u>0.13</u>	<u>7.35</u>	<u>-183.4</u>	<u>360</u>

Water Sample:

Time Collected _____

Physical Appearance at Start

Cloudy

Physical Appearance at Sampling

clear

Color

Color

Odor

Odor

Turbidity

Turbidity

Sheen/Free Product

Sheen/Free Product

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/6/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel IRS / MBR

Weather clear 62°F
 Well # GWGP-22-VAP11
 Evacuation Method Penstamatic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * _____ ft.
 Depth to Water * 7.09 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling

3 gal.(s)

Did well go dry?

No

(Other, Specify)

* Measurements taken from

☐ Well Casing☐ Protective Casing

Instrument Calibration:

Calibrated within Range

Conductivity yes
 DO yes
 pH: 7 yes 4 or 10
 ORP yes

Turbidity: zero 200 or 225

purged 8 min to remove fines -1352

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
<u>1400</u>	initial <u>120</u>	initial _____	initial <u>13.08</u>	initial <u>596</u>	initial <u>5.35</u>	initial <u>7.52</u>	initial <u>10.4</u>	initial <u>930</u>
<u>1405</u>	_____	_____	<u>14.52</u>	<u>629</u>	<u>5.09</u>	<u>7.40</u>	<u>-20.7</u>	<u>467</u>
<u>1410</u>	_____	_____	<u>14.73</u>	<u>643</u>	<u>4.80</u>	<u>7.30</u>	<u>-10.6</u>	<u>224</u>
<u>1415</u>	_____	_____	<u>14.61</u>	<u>645</u>	<u>4.64</u>	<u>7.37</u>	<u>-21.8</u>	<u>92</u>
<u>1420</u>	_____	_____	<u>14.50</u>	<u>644</u>	<u>4.63</u>	<u>7.36</u>	<u>-21.0</u>	<u>79</u>
<u>1425</u>	_____	_____	<u>14.25</u>	<u>641</u>	<u>4.69</u>	<u>7.35</u>	<u>-16.3</u>	<u>65</u>
<u>1430</u>	_____	_____	<u>14.22</u>	<u>640</u>	<u>4.81</u>	<u>7.34</u>	<u>-13.0</u>	<u>58</u>
<u>1435</u>	_____	_____	<u>14.60</u>	<u>643</u>	<u>5.27</u>	<u>7.33</u>	<u>-8.4</u>	<u>49</u>
<u>1440</u>	_____	_____	<u>14.43</u>	<u>642</u>	<u>5.31</u>	<u>7.33</u>	<u>-6.2</u>	<u>37</u>
<u>1445</u>	_____	_____	<u>14.38</u>	<u>643</u>	<u>5.48</u>	<u>7.31</u>	<u>-2.9</u>	<u>37</u>
<u>1450</u>	<u>✓</u>	_____	<u>14.359</u>	<u>646</u>	<u>5.23</u>	<u>7.33</u>	<u>-1.7</u>	<u>41</u>

Water Sample:

Time Collected

1450

Physical Appearance at Start

Color cloudy
 Odor _____
 Turbidity 930
 Sheen/Free Product _____

Physical Appearance at Sampling

Color clear
 Odor _____
 Turbidity 41
 Sheen/Free Product _____

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/6/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel _____

Weather clear 60°F
 Well # GW6P-22-VAP17
 Evacuation Method peristaltic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * _____ ft.
 Depth to Water * 6.95 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling

3 gal.(s)

Did well go dry?

no

* Measurements taken from

☐ Well Casing☐ Protective Casing☐ (Other, Specify)

Instrument Calibration:

Calibrated within Range

Conductivity yes
 DO yes
 pH: 7 yes 4 or 10
 ORP yes

Turbidity: zero 200 or 225

purged 10 min prior to monitoring to remove fines

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
<u>1250</u>	initial <u>150</u>	initial _____	initial <u>12.99</u>	initial <u>514</u>	initial <u>3.32</u>	initial <u>7.35</u>	initial <u>-32.9</u>	initial <u>164</u>
<u>1255</u>	_____	_____	<u>12.65</u>	<u>516</u>	<u>1.17</u>	<u>7.28</u>	<u>-51.8</u>	<u>199</u>
<u>1300</u>	_____	_____	<u>13.50</u>	<u>528</u>	<u>0.88</u>	<u>7.18</u>	<u>-71.6</u>	<u>476</u>
<u>1305</u>	_____	_____	<u>14.15</u>	<u>536</u>	<u>0.83</u>	<u>7.16</u>	<u>-80.8</u>	<u>578</u>
<u>1310</u>	_____	_____	<u>14.97</u>	<u>547</u>	<u>0.76</u>	<u>7.21</u>	<u>-84.0</u>	<u>490</u>
<u>1315</u>	_____	_____	<u>15.30</u>	<u>551</u>	<u>0.78</u>	<u>7.21</u>	<u>-86.2</u>	<u>455</u>
<u>1320</u>	_____	_____	<u>15.33</u>	<u>551</u>	<u>0.77</u>	<u>7.20</u>	<u>-84.8</u>	<u>380</u>
<u>1325</u>	_____	_____	<u>15.35</u>	<u>551</u>	<u>0.79</u>	<u>7.19</u>	<u>-83.1</u>	<u>333</u>
<u>1330</u>	_____	_____	<u>15.34</u>	<u>550</u>	<u>0.79</u>	<u>7.18</u>	<u>-80.3</u>	<u>274</u>
<u>1335</u>	_____	_____	<u>15.20</u>	<u>547</u>	<u>0.81</u>	<u>7.17</u>	<u>-77.2</u>	<u>210</u>
<u>1340</u>	_____	_____	<u>15.20</u>	<u>547</u>	<u>0.83</u>	<u>7.17</u>	<u>-75.1</u>	<u>98</u>

Water Sample:

Time Collected

1340

Physical Appearance at Start

Color cloudy
 Odor _____
 Turbidity 164
 Sheen/Free Product _____

Physical Appearance at Sampling

Color slightly cloudy
 Odor _____
 Turbidity 98
 Sheen/Free Product _____

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/6/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel KBS / MBR

Weather cloudy 57°F
 Well # GWGP-22-VAP 25
 Evacuation Method peristaltic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * ft.
 Depth to Water * 10-21 ft.
 Length of Water Column ft.
 Volume of Water in Well gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling 4 gal.(s)Did well go dry? NO

(Other, Specify)

* Measurements taken from

☐ Well Casing☐ Protective Casing

Instrument Calibration:

Calibrated within Range

Conductivity yes
 DO yes
 pH yes or 10 yes
 ORP yes

Turbidity: zero 200 or 225

purged 10 min prior to monitoring to remove fines

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
1145	initial 150	initial	initial 14.39	initial 674	initial 3.11	initial 6.34	initial 20.0	initial 216
1150	↓		14.09	613	0.64	6.49	-82.6	141
1155	↓		13.90	606	0.28	6.65	-115.6	103
1200	↓		13.66	587	0.24	6.75	-125.5	73
1205	↓		13.98	593	0.22	6.84	-132.3	79
1210	↓		13.92	594	0.23	6.90	-134.4	45
1215	↓		13.70	591	0.32	6.95	-134.9	47
1220	↓		13.59	587	0.33	6.93	-131.5	51
1225	↓		13.65	587	0.30	6.96	-132.1	45

Water Sample:

Time Collected

1225

Physical Appearance at Start

Color

slightly cloudy

Odor

Turbidity

216

Sheen/Free Product

Physical Appearance at Sampling

Color

clear

Odor

Turbidity

low

Sheen/Free Product

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/5/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel _____

Weather light Rain 60°F
 Well # GWGP-23-VAP21
 Evacuation Method Penstaltic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * _____ ft.
 Depth to Water * 6.28 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC
 2" Diameter Well = 0.163 X LWC
 4" Diameter Well = 0.653 X LWC

Volume removed before sampling _____ gal.(s)

Did well go dry? No

* Measurements taken from

☐ Well Casing☐ Protective Casing

(Other, Specify) _____

Instrument Calibration:

Calibrated within Range

Conductivity yes
 DO yes
 pH: 7 yes 10 yes
 ORP yes

Turbidity: zero yes 200 or 225

Purged 10 min prior to monitoring to clear fines

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
1710	initial 140	initial	initial 12.58	initial 759	initial 7.26	initial 7.57	initial -19.3	initial 588
1715			12.66	763	7.43	7.43	-27.5	560
1720			12.77	768	5.07	7.34	-41.3	364
1725			12.79	769	4.76	7.32	-42.4	152
1730			12.71	769	5.05	7.30	-44.6	60
1735			12.78	771	4.76	7.31	-45.8	36
1740			12.80	772	4.72	7.30	-45.6	34
1745			12.77	773	4.76	7.29	-44.2	32

Water Sample:

Time Collected 1745

Physical Appearance at Start

Color cloudy
 Odor high
 Turbidity high
 Sheen/Free Product _____

Physical Appearance at Sampling

Color clear
 Odor low
 Turbidity low
 Sheen/Free Product _____

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/5/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel 1005 / MBR

Weather cloudy 65°F
 Well # GWGP-23-VAP19
 Evacuation Method Peristaltic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * _____ ft.
 Depth to Water * 7.46 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling

4 gal.(s)

Did well go dry?

No

* Measurements taken from

☐ Well Casing☐ Protective Casing☐ (Other, Specify) _____

Instrument Calibration:

Calibrated within Range

Conductivity yes
 DO yes
 pH: 7 yes (or 10 yes)
 ORP yes

Turbidity: zero yes 200 or 225purged 10 min prior to monitoring to remove fines

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
1600	initial <u>120</u>	initial _____	initial <u>13.64</u>	initial <u>709</u>	initial <u>1.83</u>	initial <u>7.53</u>	initial <u>-182.9</u>	initial <u>705</u>
1605	_____	_____	<u>13.70</u>	<u>717</u>	<u>0.83</u>	<u>7.36</u>	<u>-134.7</u>	<u>649</u>
1610	_____	_____	<u>13.83</u>	<u>721</u>	<u>0.24</u>	<u>7.33</u>	<u>-144.4</u>	<u>624</u>
1615	_____	_____	<u>13.71</u>	<u>720</u>	<u>0.17</u>	<u>7.33</u>	<u>-153.1</u>	<u>594</u>
1620	_____	_____	<u>14.11</u>	<u>726</u>	<u>0.17</u>	<u>7.35</u>	<u>-157.6</u>	<u>550</u>
1625	_____	_____	<u>14.03</u>	<u>726</u>	<u>0.15</u>	<u>7.33</u>	<u>-162.5</u>	<u>528</u>
1630	_____	_____	<u>13.97</u>	<u>725</u>	<u>0.12</u>	<u>7.34</u>	<u>-166.8</u>	<u>477</u>
1635	_____	_____	<u>14.06</u>	<u>726</u>	<u>0.11</u>	<u>7.35</u>	<u>-170.4</u>	<u>436</u>
1640	_____	_____	<u>14.11</u>	<u>728</u>	<u>0.09</u>	<u>7.35</u>	<u>-172.9</u>	<u>388</u>
1645	<u>V</u>	_____	<u>13.84</u>	<u>723</u>	<u>0.09</u>	<u>7.35</u>	<u>-173.2</u>	<u>342</u>
1650	_____	_____	<u>13.63</u>	<u>719</u>	<u>0.09</u>	<u>7.33</u>	<u>-172.4</u>	<u>316</u>

Water Sample:

Time Collected

1650

Physical Appearance at Start

Color cloudy
 Odor _____
 Turbidity high
 Sheen/Free Product _____

Physical Appearance at Sampling

Color cloudy
 Odor _____
 Turbidity high
 Sheen/Free Product _____

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/5/10
 Site Name NBIA GW Delineation Study
 Location Branson, MI
 Project No. 12716/41845.002.001
 Personnel _____

Weather cloudy 64°F
 Well # GWGP-03-VAP24
 Evacuation Method Peristaltic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * _____ ft.
 Depth to Water * 6.18 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling 4 gal.(s)Did well go dry? NO

* Measurements taken from

☐ Well Casing☐ Protective Casing

(Other, Specify) _____

Instrument Calibration:

Calibrated within Range

Conductivity yes
 DO yes
 pH: 7 yes 4 or 10
 ORP yes

Turbidity: zero 200 or 225

Purged 13 min prior to monitoring to remove fines

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
<u>1450</u>	initial <u>140</u>	initial _____	initial <u>13.74</u>	initial <u>615</u>	initial <u>5.72</u>	initial <u>7.55</u>	initial <u>-186.7</u>	initial <u>1106</u>
<u>1455</u>	_____	_____	<u>13.70</u>	<u>619</u>	<u>0.47</u>	<u>7.41</u>	<u>-167.5</u>	<u>1102</u>
<u>1500</u>	_____	_____	<u>14.15</u>	<u>622</u>	<u>0.19</u>	<u>7.39</u>	<u>-180.5</u>	<u>1100</u>
<u>1505</u>	_____	_____	<u>14.13</u>	<u>622</u>	<u>0.15</u>	<u>7.40</u>	<u>-184.7</u>	<u>1108</u>
<u>1510</u>	_____	_____	<u>14.21</u>	<u>623</u>	<u>0.13</u>	<u>7.41</u>	<u>-187.9</u>	<u>1108</u>
<u>1515</u>	_____	_____	<u>13.87</u>	<u>615</u>	<u>0.10</u>	<u>7.41</u>	<u>-188.5</u>	<u>1100</u>
<u>1520</u>	_____	_____	<u>13.69</u>	<u>612</u>	<u>0.07</u>	<u>7.38</u>	<u>-188.2</u>	<u>1100</u>
<u>1525</u>	_____	_____	<u>13.76</u>	<u>614</u>	<u>0.06</u>	<u>7.38</u>	<u>-188.8</u>	<u>1100</u>
<u>1530</u>	_____	_____	<u>13.94</u>	<u>617</u>	<u>0.05</u>	<u>7.40</u>	<u>-189.7</u>	<u>1100</u>
<u>1535</u>	_____	_____	<u>14.13</u>	<u>618</u>	<u>0.06</u>	<u>7.39</u>	<u>-189.4</u>	<u>1100</u>
<u>1540</u>	<u>N</u>	_____	<u>14.08</u>	<u>619</u>	<u>0.05</u>	<u>7.42</u>	<u>-191.2</u>	<u>1100</u>

Water Sample:

Time Collected 1540

Physical Appearance at Start

Color cloudy
 Odor _____
 Turbidity high
 Sheen/Free Product _____

Physical Appearance at Sampling

Color cloudy
 Odor _____
 Turbidity 1100
 Sheen/Free Product _____

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/5/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel _____

Weather

clear 70°F

Well #

GW GP - 23-VAP 29.5

Evacuation Method

peristaltic pump

Sampling Method

Low-flow

Well Information:

Depth of Well * _____ ft.
 Depth to Water * 7.35 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling _____ gal.(s)

Did well go dry?

No

(Other, Specify) _____

* Measurements taken from

☐ Well Casing☐ Protective Casing☐

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes 8 or 10
 ORP Yes

Turbidity: zero Yes 200 or 225

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
1340	initial 160	initial	initial 15.91	initial 678	initial 2.59	initial 7.33	initial -145.9	initial 170
1345			15.46	680	2.28	7.42	-141.5	154
1350			14.94	670	0.58	7.33	-152.2	117
1355			15.21	672	0.27	7.33	-159.9	139
1400			15.37	676	0.23	7.34	-166.5	151
1405			15.55	680	0.25	7.35	-174.0	288
1410			15.38	678	0.25	7.36	-177.3	366
1415			15.66	682	0.27	7.37	-180.3	361
1420			16.15	689	0.24	7.38	-184.0	423
1425			16.02	688	0.19	7.41	-187.1	439
1430			16.00	687	0.17	7.41	-187.4	450

Water Sample:

Time Collected

1430

Physical Appearance at Start

Color

cloudy

Odor

—

Turbidity

high

Sheen/Free Product

—

Physical Appearance at Sampling

Color

cloudy

Odor

—

Turbidity

high

Sheen/Free Product

—

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/5/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel KRS

Weather clear 68°F
 Well # GP-23-VAP36
 Evacuation Method Peristaltic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * _____ ft.
 Depth to Water * 7.06 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:
 1" Diameter Well = 0.041 X LWC
 2" Diameter Well = 0.163 X LWC
 4" Diameter Well = 0.653 X LWC

Volume removed before sampling 3 gal.(s)
 Did well go dry? NO

* Measurements taken from ☐ Well Casing ☐ Protective Casing ☐ (Other, Specify) _____

Instrument Calibration:

Calibrated within Range

Conductivity yes
 DO yes
 pH: 7 yes @ or 10
 ORP yes

Turbidity: zero 200 or 225

Pumped 10 min prior to monitoring to remove fines 1220

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
<u>1230</u>	initial <u>120</u>	initial _____	initial <u>16.35</u>	initial <u>818</u>	initial <u>2.28</u>	initial <u>6.27</u>	initial <u>-68.5</u>	initial <u>183</u>
<u>1235</u>	_____	_____	<u>16.44</u>	<u>803</u>	<u>0.78</u>	<u>6.62</u>	<u>-100.4</u>	<u>176</u>
<u>1240</u>	_____	_____	<u>16.51</u>	<u>801</u>	<u>0.40</u>	<u>6.76</u>	<u>-130.7</u>	<u>153</u>
<u>1245</u>	_____	_____	<u>17.19</u>	<u>810</u>	<u>0.30</u>	<u>6.92</u>	<u>-139.9</u>	<u>122</u>
<u>1250</u>	_____	_____	<u>17.07</u>	<u>814</u>	<u>0.31</u>	<u>7.04</u>	<u>-151.7</u>	<u>106</u>
<u>1255</u>	_____	_____	<u>16.42</u>	<u>801</u>	<u>0.26</u>	<u>7.10</u>	<u>-156.7</u>	<u>109</u>
<u>1300</u>	_____	_____	<u>16.40</u>	<u>797</u>	<u>0.23</u>	<u>7.14</u>	<u>-157.5</u>	<u>108</u>
<u>1305</u>	_____	_____	<u>16.03</u>	<u>792</u>	<u>0.25</u>	<u>7.17</u>	<u>-160.1</u>	<u>108</u>
<u>1310</u>	_____	_____	<u>16.14</u>	<u>794</u>	<u>0.26</u>	<u>7.20</u>	<u>-161.2</u>	<u>127</u>
<u>1315</u>	_____	_____	<u>16.16</u>	<u>794</u>	<u>0.28</u>	<u>7.21</u>	<u>-161.7</u>	<u>149</u>
<u>1320</u>	<u>↓</u>	_____	<u>16.25</u>	<u>795</u>	<u>0.32</u>	<u>7.23</u>	<u>-163.0</u>	_____

Water Sample:

Time Collected 1320

Physical Appearance at Start

Color _____
 Odor _____
 Turbidity _____
 Sheen/Free Product _____

Physical Appearance at Sampling

Color _____
 Odor _____
 Turbidity _____
 Sheen/Free Product _____

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/4/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel _____

Weather clear 70°F
 Well # GP-24-UAP7
 Evacuation Method Peristaltic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * _____ ft.
 Depth to Water * 4.99 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling 4.5 gal.(s)Did well go dry? NO

(Other, Specify) _____

* Measurements taken from

☐ Well Casing☐ Protective Casing

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes @ or 10 Yes
 ORP Yes

Turbidity: zero Yes 200 or 225

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
<u>1450</u>	initial <u>140</u>	initial _____	initial <u>16.52</u>	initial <u>408</u>	initial <u>6.67</u>	initial <u>7.71</u>	initial <u>-63.1</u>	initial <u>1100</u>
<u>1455</u>	_____	_____	<u>15.07</u>	<u>357</u>	<u>3.55</u>	<u>7.47</u>	<u>-69.8</u>	<u>916</u>
<u>1500</u>	_____	_____	<u>14.18</u>	<u>335</u>	<u>0.65</u>	<u>7.23</u>	<u>-64.7</u>	<u>782</u>
<u>1505</u>	_____	_____	<u>13.70</u>	<u>304</u>	<u>0.60</u>	<u>7.06</u>	<u>-48.8</u>	<u>539</u>
<u>1510</u>	_____	_____	<u>13.70</u>	<u>294</u>	<u>0.58</u>	<u>6.97</u>	<u>-36.9</u>	<u>441</u>
<u>1515</u>	_____	_____	<u>13.75</u>	<u>293</u>	<u>0.57</u>	<u>6.88</u>	<u>-25.9</u>	<u>362</u>
<u>1520</u>	_____	_____	<u>13.77</u>	<u>292</u>	<u>0.58</u>	<u>6.83</u>	<u>-19.6</u>	<u>340</u>
<u>1525</u>	_____	_____	<u>13.31</u>	<u>284</u>	<u>0.65</u>	<u>6.78</u>	<u>-12.5</u>	<u>310</u>
<u>1530</u>	_____	_____	<u>13.59</u>	<u>287</u>	<u>0.66</u>	<u>6.72</u>	<u>-8.3</u>	<u>282</u>
<u>1535</u>	_____	_____	<u>13.87</u>	<u>287</u>	<u>0.70</u>	<u>6.74</u>	<u>-7.2</u>	<u>286</u>
<u>1540</u>	_____	_____	<u>13.91</u>	<u>288</u>	<u>0.72</u>	<u>6.71</u>	<u>-4.7</u>	<u>230</u>

Water Sample:

Time Collected 1540

Physical Appearance at Start

Color cloudy
 Odor _____
 Turbidity 1100
 Sheen/Free Product _____

Physical Appearance at Sampling

Color slightly cloudy
 Odor _____
 Turbidity 230
 Sheen/Free Product _____

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/4/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel KBS

Weather clear sunny 70°F
 Well # GP-24-VAP II
 Evacuation Method peristaltic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * _____ ft.
 Depth to Water * 6.35 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:
 1" Diameter Well = 0.041 X LWC
 2" Diameter Well = 0.163 X LWC
 4" Diameter Well = 0.653 X LWC

Volume removed before sampling _____ gal.(s)
 Did well go dry? NO

* Measurements taken from

☐ Well Casing☐ Protective Casing☐ (Other, Specify) _____

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes @ or 10 Yes
 ORP Yes

Turbidity: zero 200 or 225

Purged 10 min prior to monitoring to remove fines

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
1335	initial 50	initial	initial 18.74	initial 681	initial 9.84	initial 7.73	initial -43.1	initial 384
1340			18.78	680	9.75	7.73	-35.7	359
1345			18.85	680	9.74	7.74	-32.4	325
1350			18.88	680	9.72	7.75	-32.7	282
1355			18.94	679	9.69	7.76	-36.7	249
1400			19.06	680	9.63	7.77	-41.1	208
1405			19.03	679	9.63	7.77	-43.1	174
1410			18.91	677	9.65	7.76	-45.4	144
1415			19.15	680	9.59	7.77	-48.0	120
1420			19.44	683	9.50	7.79	-48.1	93
1425			19.47	688	9.46	7.79	-48.6	174

Water Sample:

Time Collected

1425

Physical Appearance at Start

Color cloudy
 Odor _____
 Turbidity 389
 Sheen/Free Product _____

Physical Appearance at Sampling

Color slightly cloudy
 Odor _____
 Turbidity _____
 Sheen/Free Product _____

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

Turb 80 NTU during sampling

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/4/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel _____

Weather Scattered clouds 65°F
 Well # GP-24-VAP24
 Evacuation Method Peristaltic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * 24.0 ft.
 Depth to Water * 16.74 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC
 2" Diameter Well = 0.163 X LWC
 4" Diameter Well = 0.653 X LWC

Volume removed before sampling _____ gal.(s)

Did well go dry? No

* Measurements taken from

☐ Well Casing☐ Protective Casing☐ (Other, Specify) _____

Instrument Calibration:

Calibrated within Range

Conductivity yes
 DO yes
 pH: 7 yes @ or 10 yes
 ORP yes

Turbidity: zero 200 or 225

Water parameters:

*Start purging at 11:40 at higher rate to
 begin to remove fines*

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
12:00	initial <u>120</u>	initial _____	initial <u>15.66</u>	initial <u>717</u>	initial <u>3.98</u>	initial <u>6.90</u>	initial <u>-144.6</u>	initial <u>148</u>
12:05	_____	_____	<u>15.42</u>	<u>711</u>	<u>1.67</u>	<u>6.95</u>	<u>-149.2</u>	<u>146</u>
12:10	_____	_____	<u>15.37</u>	<u>709</u>	<u>1.93</u>	<u>7.10</u>	<u>-143.5</u>	<u>107</u>
12:15	_____	_____	<u>15.31</u>	<u>708</u>	<u>2.57</u>	<u>7.05</u>	<u>-138.8</u>	<u>96</u>
12:20	_____	_____	<u>15.47</u>	<u>709</u>	<u>3.29</u>	<u>7.09</u>	<u>-134.3</u>	<u>85</u>
12:25	_____	_____	<u>15.44</u>	<u>710</u>	<u>3.85</u>	<u>7.09</u>	<u>-129.5</u>	<u>77</u>
12:30	_____	_____	<u>15.15</u>	<u>705</u>	<u>3.70</u>	<u>7.11</u>	<u>-127.6</u>	<u>77</u>
12:35	_____	_____	<u>15.32</u>	<u>707</u>	<u>3.18</u>	<u>7.13</u>	<u>-130.7</u>	<u>68</u>
12:40	_____	_____	<u>16.07</u>	<u>719</u>	<u>2.39</u>	<u>7.18</u>	<u>-138.4</u>	<u>67</u>

Water Sample:

Time Collected 12:42Physical Appearance at Start of purging

Physical Appearance at Sampling _____

Color Grayish Brown
 Odor _____
 Turbidity Very
 Sheen/Free Product _____

Color Slightly Cloudy - light Brown
 Odor _____
 Turbidity Slightly Cloudy
 Sheen/Free Product _____

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/2/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel CSH/KBS

Weather Partly Cloudy to Cloudy South of 20
 Well # GP-25 WPT 7.5
 Evacuation Method peristaltic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * temporary 7.5 ft.
 Depth to Water * 3.32 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:
 1" Diameter Well = 0.041 X LWC
 2" Diameter Well = 0.163 X LWC
 4" Diameter Well = 0.653 X LWC

Volume removed before sampling _____ gal.(s)
 Did well go dry? _____

* Measurements taken from ☐ Well Casing ☐ Protective Casing ☐ (Other, Specify) _____

Instrument Calibration: Calibrated within Range

Conductivity ☒
 DO ☒
 pH: 7 ☒ 4 or 10 ☒
 ORP ☒

Turbidity: zero _____ 200 or 225 _____

Water parameters:

Start pumping at 4:59 pm pump 10 minutes then start readings

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
17:09	initial	initial	initial 13.00	initial 722	initial 0.35	initial 7.39	initial -123.0	initial 124
17:17			13.42	735	0.17	7.32	-120.6	475
17:19			14.42	748	0.20	7.38	-123.2	393
17:24			14.07	745	0.16	7.36	-118.4	169
17:29			13.97	743	0.17	7.33	-117.2	133
17:34			13.66	739	0.16	7.30	-115.9	95
17:39			13.09	729	0.15	7.28	-115.1	65
17:44			12.96	722	0.12	7.26	-114.1	58
17:49			12.88	724	0.10	7.25	-113.5	49
17:54			12.83	723	0.09	7.24	-113.0	47
17:59			12.86	723	0.09	7.24	-112.1	52

Water Sample:

Time Collected 18:00

Physical Appearance at Start of Sampling

Color Slightly Cloudy - light brown
 Odor _____
 Turbidity Slightly cloudy
 Sheen/Free Product _____

Physical Appearance at Sampling

Color Same
 Odor _____
 Turbidity _____
 Sheen/Free Product _____

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/3/10
 Site Name NBIA GW Delineation Study
 Location Branson, MI
 Project No. 12716/41845.002.001
 Personnel KSS

Weather light Rain 65°F
 Well # GP-25-VAP 11.5
 Evacuation Method Peristaltic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * ft.
 Depth to Water * 3.24 ft.
 Length of Water Column ft.
 Volume of Water in Well gal.(s)

Water Volume /ft. for:
 1" Diameter Well = 0.041 X LWC
 2" Diameter Well = 0.163 X LWC
 4" Diameter Well = 0.653 X LWC

Volume removed before sampling 9 gal.(s)
 Did well go dry? No

* Measurements taken from

☐ Well Casing☐ Protective Casing☐ (Other, Specify)

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes @ or 10 Yes
 ORP Yes

Turbidity: zero 200 or 225

pumped 10 min prior to monitoring

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
1600	initial 200	initial	initial 12.30	initial 671	initial 0.73	initial 7.52	initial -128.6	initial 256
1605	160		12.44	654	0.27	7.39	-135.2	190
1610			13.31	666	0.22	7.39	-141.0	170
1615			13.14	667	0.22	7.39	-143.6	154
1620			13.57	674	0.17	7.37	-144.8	159
1625			13.40	672	0.17	7.39	-147.3	152
1630			13.33	670	0.13	7.37	-147.0	110
1635			13.18	667	0.13	7.36	-147.4	92
1640			13.25	668	0.11	7.33	-147.3	76
1645			13.39	670	0.10	7.34	-148.5	65
1650			13.62	674	0.11	7.34	-148.0	57

Water Sample:

Time Collected

1650

Physical Appearance at Start

Color cloudy
 Odor
 Turbidity 256
 Sheen/Free Product

Physical Appearance at Sampling

Color clear
 Odor
 Turbidity 65
 Sheen/Free Product

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/3/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel KBS

Weather clear 70°F
 Well # GP-25-VAP19.5
 Evacuation Method Peristaltic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * ft.
 Depth to Water * 4.42 ft.
 Length of Water Column ft.
 Volume of Water in Well gal.(s)

Water Volume /ft. for:
 1" Diameter Well = 0.041 X LWC
 2" Diameter Well = 0.163 X LWC
 4" Diameter Well = 0.653 X LWC

Volume removed before sampling 5 gal.(s)
 Did well go dry? no

* Measurements taken from ☐ Well Casing ☐ Protective Casing ☐ (Other, Specify)

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes 4 or 10 Yes
 ORP Yes

Turbidity: zero 200 or 225

Purge 10 min Prior to Monitoring

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
<u>1445</u>	initial <u>180</u>	initial <u> </u>	initial <u>15.86</u>	initial <u>568</u>	initial <u>0.38</u>	initial <u>7.61</u>	initial <u>-146.0</u>	initial <u>267</u>
<u>1450</u>	<u> </u>	<u> </u>	<u>15.66</u>	<u>562</u>	<u>0.40</u>	<u>7.47</u>	<u>-142.0</u>	<u>183</u>
<u>14:55</u>	<u> </u>	<u> </u>	<u>15.62</u>	<u>556</u>	<u>0.48</u>	<u>7.36</u>	<u>-130.1</u>	<u>111</u>
<u>15:00</u>	<u> </u>	<u> </u>	<u>15.41</u>	<u>554</u>	<u>0.53</u>	<u>7.33</u>	<u>-120.2</u>	<u>88</u>
<u>1505</u>	<u> </u>	<u> </u>	<u>15.36</u>	<u>553</u>	<u>0.62</u>	<u>7.31</u>	<u>-121.1</u>	<u>90</u>
<u>1510</u>	<u> </u>	<u> </u>	<u>15.50</u>	<u>554</u>	<u>0.71</u>	<u>7.33</u>	<u>-134.4</u>	<u>94</u>
<u>1515</u>	<u> </u>	<u> </u>	<u>15.47</u>	<u>554</u>	<u>0.68</u>	<u>7.32</u>	<u>-137.9</u>	<u>107</u>
<u>1520</u>	<u> </u>	<u> </u>	<u>15.66</u>	<u>556</u>	<u>0.51</u>	<u>7.32</u>	<u>-142.1</u>	<u>115</u>
<u>1525</u>	<u> </u>	<u> </u>	<u>15.40</u>	<u>553</u>	<u>0.38</u>	<u>7.31</u>	<u>-143.7</u>	<u>124</u>
<u>1530</u>	<u> </u>	<u> </u>	<u>14.80</u>	<u>545</u>	<u>0.24</u>	<u>7.28</u>	<u>-145.2</u>	<u>116</u>
<u>1535</u>	<u> </u>	<u> </u>	<u>15.44</u>	<u>552</u>	<u>0.21</u>	<u>7.32</u>	<u>-146.8</u>	<u>113</u>

Water Sample:

Time Collected 1535

Physical Appearance at Start

Color cloudy
 Odor
 Turbidity 267
 Sheen/Free Product

Physical Appearance at Sampling

Color slightly cloudy
 Odor
 Turbidity 113
 Sheen/Free Product

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/3/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel KBS

Weather Clear 70°F
 Well # GP-25 - VAP-27.5
 Evacuation Method Peristaltic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * ft.
 Depth to Water * 4.01 ft.
 Length of Water Column ft.
 Volume of Water in Well gal(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC
 2" Diameter Well = 0.163 X LWC
 4" Diameter Well = 0.653 X LWC

Volume removed before sampling 4 gal(s)Did well go dry? NO(Other, Specify)

* Measurements taken from

☐ Well Casing☐ Protective Casing

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes @ 10 Yes
 ORP Yes

Turbidity: zero 200 or 225

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
1320	initial 140	initial	initial 13.86	initial 540	initial 1.100	initial 6.43	initial -73.2	initial 76
1325	140		15.79	513	0.88	6.83	-136.6	21
1330	140		16.17	520	0.79	7.02	-139.7	19
1335	140		16.47	533	0.66	7.19	-174.2	31
1340	140		16.69	535	0.62	7.30	-153.7	52
1345	140		16.59	536	0.64	7.36	-169.9	14
1350	140		16.14	534	0.66	7.41	-177.9	8
1355	140		15.71	525	0.67	7.42	-179.6	12
1400	140		15.82	527	0.59	7.41	-165.3	14
1405	140		16.13	529	0.56	7.42	-136.0	20
1410	140		16.32	532	0.60	7.50	-173.2	23

Water Sample:

Time Collected 14201415
142015.74
16.10527
5200.51
0.487.51
7.48-177.1
-166.229
93

Physical Appearance at Start

Physical Appearance at Sampling

Color cloudy
 Odor
 Turbidity 76
 Sheen/Free Product

Color clear
 Odor
 Turbidity 33
 Sheen/Free Product

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/11/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel _____

Weather Overcast 45°F
 Well # GW01-26-VA124
 Evacuation Method Peristaltic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * _____ ft.
 Depth to Water * _____ ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling 4 gal.(s)Did well go dry? NO

* Measurements taken from

☐ Well Casing☐ Protective Casing

(Other, Specify) _____

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes 4 or 10
 ORP Yes

Turbidity: zero Yes 200 or 225

pumped 10 min. Prior to monitoring 1010

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
1020	initial 150	initial	initial 9.88	initial 584	initial 4.69	initial 7.36	initial -23.1	initial 121
1025			9.81	587	2.35	7.41	-89.6	184
1030			9.80	584	1.34	7.34	-131.2	211
1035			9.72	579	0.25	7.22	-137.0	246
1040			9.14	577	0.15	7.22	-149.5	300
1045			8.79	572	0.15	7.23	-156.8	437
1050			8.90	573	0.14	7.24	-160.0	511
1055			8.77	571	0.09	7.25	-166.1	522
1100			8.77	570	0.08	7.28	-168.5	610
1105			8.77	571	0.06	7.28	-171.2	681
1110			8.89	571	0.07	7.29	-171.1	704

Water Sample:

Time Collected 1110

Physical Appearance at Start

Color cloudy
 Odor _____
 Turbidity high
 Sheen/Free Product _____

Physical Appearance at Sampling

Color cloudy
 Odor _____
 Turbidity high
 Sheen/Free Product _____

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 5/11/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel _____

Weather Overcast 45°F
 Well # GWGP-26-VAP 31
 Evacuation Method Peristaltic pump
 Sampling Method Low-flow

Well Information:

Depth of Well * _____ ft.
 Depth to Water * 3.94 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling 4.5 gal.(s)Did well go dry? No

* Measurements taken from

☐ Well Casing☐ Protective Casing

(Other, Specify) _____

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes 4 or 10 Yes
 ORP Yes

Turbidity: zero Yes 200 or 225

Purged 10 min prior to monitoring 8:58

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
910	initial 150	initial	initial 10.02	initial 653	initial 0.93	initial 6.20	initial -63.9	initial
915			9.57	667	0.59	6.44	-102.9	84
920			9.41	597	0.38	6.62	-130.0	164
925			9.37	596	0.34	6.76	-136.4	
930			9.48	598	0.32	6.84	-141.1	154
935			9.50	597	0.28	6.91	-144.1	132
940			9.43	590	0.21	6.99	-147.4	146
945			9.45	596	0.15	7.02	-147.3	144
950			9.44	595	0.11	7.06	-148.8	163
955			9.41	595	0.10	7.09	-149.7	174
1000			9.38	596	0.09	7.09		

Water Sample:

Time Collected 1000

Physical Appearance at Start

Color Slightly cloudy
 Odor _____
 Turbidity med
 Sheen/Free Product _____

Physical Appearance at Sampling

Color cloudy
 Odor _____
 Turbidity high
 Sheen/Free Product _____

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Filter Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 6/10/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel C. Cox/K. Schneider
 Weather Sunny, 70°
 Well # MW-6D
 Evacuation Method Bladder pump
 Sampling Method Low-flow

Well Information:

Depth of Well * _____ ft.
 Depth to Water * 5.55 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling 2 gal.(s)Did well go dry? No

* Measurements taken from

☒ Well Casing☐ Protective Casing

(Other, Specify) _____

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes 4 or 10
 ORP Yes

Turbidity: zero Yes 200 or 225

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
0815	initial 100	initial 5.57	initial 19.74	initial 584	initial 2.49	initial 7.08	initial 19.0	initial 1179.0
0820	100	5.57	18.68	591	2.01	7.28	3.8	569.4
0825	100	5.57	16.61	603	1.45	7.37	-26.9	142.3
0830	100	5.57	16.57	617	0.85	7.44	-107.2	104.5
0835	100	5.57	16.20	690	0.75	7.04	-107.4	96.1
0840	100	5.57	16.17	688	0.54	6.97	-107.1	90.8
0845	100	5.57	16.34	691	0.44	6.95	-107.0	75.2
0850	100	5.57	16.44	694	0.42	6.96	-108.5	65.0
0855	100	5.57	16.47	692	0.38	7.00	-110.6	41.8
0900	100	5.57	16.50	693	0.37	7.01	-111.3	40.9

Water Sample:

Time Collected 0930

Physical Appearance at Start

Physical Appearance at Sampling

Color Cloudy
 Odor _____
 Turbidity 1179.0
 Sheen/Free Product _____

Color Clear
 Odor _____
 Turbidity 25
 Sheen/Free Product _____

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8280B	3	40 ml vials	HCL	No
Metals	3005A/6010B and 7470A	1	1 L	NHO ₃	No
Cyanide (total and free)	9012A and SM 4500	1	250 ml Poly	NaOH	No

Notes:

+ MW DUP-02

Time	Rate	Drawdown	Temp	Cond	DO	pH	ORP	Turb
0905	100	5.57	16.51	693	0.37 4.83	7.04	-112.1	37.6
0910	100	5.57	16.59	694	0.40	7.04	-112.3	31.9
0915	102	5.57	16.69	695	0.34	7.06	-112.9	31.6
0920	102	5.57	16.79	697	0.34	7.07	-112.7	28.3

Sample Time 0930

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 6/10/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel C. Cox/K. Schneider

Weather Sunny, 70°
 Well # MW-33i
 Evacuation Method Shaller pump
 Sampling Method Low-flow

Well Information:

Depth of Well * ft.
 Depth to Water * 6.75 ft.
 Length of Water Column ft.
 Volume of Water in Well gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling 2 gal.(s)Did well go dry? X

* Measurements taken from

☒ Well Casing☐ Protective Casing(Other, Specify)

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes 4.0 or 10
 ORP Yes

Turbidity: Zero Yes 200 or 225

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
1030	initial 100	initial 6.35	initial 19.58	initial 698	initial 2.51	initial 7.21	initial -78	initial 645.3
1035	100	6.82	19.24	727	1.60	7.47	-91	203.0
1040	100	6.82	18.01	706	0.79	7.33	-99.6	106.9
1045	100	6.82	17.24	694	0.44	7.25	-104.4	42.5
1050	100	6.82	16.99	690	0.42	7.26	-107.3	24.6
1055	100	6.82	17.31	694	0.39	7.26	-107.1	33.5
1100	100	6.82	17.34	696	0.41	7.24	-106.4	23.9
1105	100	6.83	17.37	698	0.43	7.24	-107.5	14.6
1110	100	6.83	17.41	698	0.42	7.23	-106.9	15.2
1115	100	6.83	17.43	700	0.43	7.23	-107.1	14.8

Water Sample:

Time Collected

1130

Physical Appearance at Start

Physical Appearance at Sampling

Color Cloudy
 Odor
 Turbidity 645
 Sheen/Free Product

Color Clear
 Odor
 Turbidity 15
 Sheen/Free Product

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No
Metals		1	1 L	NH ₄ OH	
Cyanide		1	250 ml	NaOH	

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 6/8/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12718/41845.002.001
 Personnel KBS/CC

Weather cloudy, PM rain 70s
 Well # MW-39
 Evacuation Method Bladder pump
 Sampling Method Low-flow

Well Information:

Depth of Well * ft.
 Depth to Water * 7.35 ft.
 Length of Water Column ft.
 Volume of Water in Well gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC
 2" Diameter Well = 0.163 X LWC
 4" Diameter Well = 0.653 X LWC

Volume removed before sampling 2 3/4 gal.(s)Did well go dry? NO

* Measurements taken from

☐ Well Casing☐ Protective Casing(Other, Specify)

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes 4 or 10 Yes
 ORP Yes

Turbidity: zero Yes 200 or 225

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
830	initial 140	initial 7.35	initial 11.93	initial 515	initial 1.49	initial 6.47	initial 26.7	initial 256
835		7.35	12.36	509	0.75	6.56	18.3	179
840		7.35	13.10	518	0.71	6.79	11.7	148
845		7.35	13.12	519	0.54	6.84	8.6	205
850		7.35	12.95	516	0.41	6.89	9.2	172
855		7.35	12.75	514	0.40	6.90	6.7	94
900		7.35	12.75	513	0.33	6.92	2.5	78
905		7.35	12.77	513	0.28	6.93	-5.3	75
910		7.35	12.59	511	0.21	6.94	-17.4	45
915		7.35	12.89	513	0.16	6.94	-21.3	37
920	✓	7.35	13.39	520	0.13	6.98	-25.5	38

Water Sample:

Time Collected 940

Physical Appearance at Start

Color rust color
 Odor
 Turbidity 256
 Sheen/Free Product

Physical Appearance at Sampling

Color clear
 Odor
 Turbidity
 Sheen/Free Product

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No
Metals		1	1 L	NH ₄ OH	
Cyanide		1	250 ml	N-OH	

Notes:

Time	Pump	DD	Temp	Con	DO	pH	ORP	Turb
925	140	7.35	13.64	525	0.14	7.02	-31.9	22
930	140	7.35	13.57	524	0.13	7.02	-32.7	11
935	140	7.35	13.62	524	0.14	7.01	-33.2	9
940	140	7.35	13.71	526	0.12	7.02	-33.2	

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 6/8/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel C. Cox / K. Schneider

Weather Cloudy, PM Rain, 70°
 Well # MW-40
 Evacuation Method bladder pump
 Sampling Method Low-flow

Well Information:

Depth of Well * _____ ft.
 Depth to Water * 7.17 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling

2.5 gal(s)

Did well go dry?

No

* Measurements taken from

☒ Well Casing☐ Protective Casing

(Other, Specify)

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes 4 or 10
 ORP Yes

Turbidity: zero Yes 200 or 25

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
0800	initial 100	initial 7.30	initial 15.67	initial 0.030	initial 2.84	initial 5.93	initial 224.9	initial 1182.0
0805	100	7.29	14.53	0.666	2.79	6.79	40.6	1176.3
0810	100	7.28	15.35	0.586	2.41	7.31	24.3	1186.7
0815	100	7.27	15.92	0.573	2.05	7.39	18.6	1133.7
0820	100	7.28	14.95	1.024	1.07	7.36	-54.6	500.9
0825	100	7.28	14.59	1.020	0.89	7.33	-62.2	344.2
0830	100	7.29	14.62	1.016	0.71	7.33	-69.8	270.1
0835	100	7.30	14.46	1.019	0.61	7.35	-70.4	195.6
0840	100	7.30	14.00	1.019	0.58	7.34	-73.5	137.6
0845	100	7.31	13.65	1.019	0.53	7.33	-76.0	74.9

Water Sample:

Time Collected 0920

Physical Appearance at Start

Physical Appearance at Sampling

Color Cloudy
 Odor _____
 Turbidity 1182
 Sheen/Free Product _____

Color Clear
 Odor _____
 Turbidity 28.4
 Sheen/Free Product _____

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No
Metals	3005A/6010B and 7470A	1	1 L	NHO ₃	No
Cyanide (total and free)	9012A and SM 4500	1	250 ml Poly	NaOH	No

Notes:

Time	Rate	Drawdown	Temp	Cond	DO	pH	ORP	Turb
0850	100	7.31	13.55	1.017	0.53	7.32	-77.3	62.7
0855	100	7.31	13.63	1.015	0.52	7.33	-78.0	39.8
0900	100	7.31	13.69	1.016	0.50	7.33	-79.2	34.4
0905	100	7.32	13.78	1.015	0.48	7.34	-84.8	34.5
0910	100	7.32	13.98	1.015	0.50	7.33	-83.0	31.5
0915	100	7.32	14.02	1.014	0.48	7.35	-82.3	28.4

Sample
0920

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 6/9/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel C. Cox/K. Schneider

Weather Cloudy, Misty, 70°
 Well # MW-41
 Evacuation Method Bladder pump
 Sampling Method Low-flow

Well Information:

Depth of Well * ft.
 Depth to Water * 4.65 ft.
 Length of Water Column ft.
 Volume of Water in Well gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling 2 gal.(s)Did well go dry? No

(Other, Specify)

* Measurements taken from

☒ Well Casing☐ Protective Casing

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes or 10
 ORP Yes

Turbidity: zero Yes 200 or 225

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
1100	initial 100	initial 4.72	initial 21.47	initial 0.852	initial 2.75	initial 7.91	initial -5.0	initial 1242.6
1105	100	4.72	20.21	0.871	2.76	8.57	-23.9	1230.8
1110	100	4.72	20.31	0.883	2.45	8.80	-31.3	1231.8
1115	100	4.73	20.55	0.890	1.62	9.01	-32.6	1233.9
1120	100	4.73	20.83	0.893	1.01	9.12	-31.3	783.5
1125	100	4.73	21.15	0.895	0.93	10.07	-30.0	657.0
1130	100	4.72	21.75	0.899	0.90	11.30	-24.7	582.4
1135	100	4.72	21.88	0.902	0.87	11.66	-23.3	606.1
1140	100	4.72	21.44	0.911	0.58	11.86	-42.6	486.1
1145	100	4.72	20.68	0.913	0.63	12.07	-59.1	637.1

Water Sample:

Time Collected 1310

Physical Appearance at Start

Physical Appearance at Sampling

Color Cloudy
 Odor
 Turbidity 1242.6
 Sheen/Free Product

Color Clear
 Odor
 Turbidity 28.4
 Sheen/Free Product

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No
Metals	3005A/6010B and 7470A	1	1 L	NH ₄ OH	No
Cyanide (total and free)	9012A and SM 4500	1	250 ml Poly	NaOH	No

Notes:

pH w/ other flow cell meter read - 6.97

Time	Rate	Drawdown	Temp	Cond	DO	pH	ORP	Turb
1150	100	4.73	20.80	0.910	0.54	12.25	-66.7	524.7
1155	100	4.73	21.15	0.908	0.50	12.43	-69.4	279.6
1200	100	4.73	21.55	0.910	0.43	12.38	-71.3	252.1
1205	100	4.73	21.95	0.908	0.43	12.41	-73.5	194.0
1210	100	4.73	22.34	0.909	0.42	12.22	-72.0	157.4
1215	100	4.73	22.79	0.910	0.43	12.09	-75.5	135.1
1220	100	4.73	22.98	0.910	0.40	11.79	-72.6	127.3
1225	100	4.72	23.35	0.908	0.42	11.46	-74.6	104.6
1230	100	4.72	23.35	0.910	0.38	11.29	-82.8	146.3
1235	100	4.72	22.76	0.911	0.40	11.31	-89.7	97.9
1240	100	4.72	22.44	0.909	0.37	11.62	-85.9	73.8
1245	100	4.72	22.54	0.903	0.38	11.82	-93.6	58.2
1250	100	4.72	22.80	0.901	0.36	11.73	-95.0	66.0
1255	100	4.72	22.84	0.900	0.41	11.64	-98.6	54.1
1300	100	4.72	22.93	0.899	0.37	11.51	-97.4	44.5
1305	100	4.73	22.98	0.901	0.39	11.46	-99.1	57.6

Sample 1310

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 6/7/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12718/41845.002.001
 Personnel C. Cox / K. Schneider

Weather Partly Cloudy, 70s
 Well # MW-42
 Evacuation Method Bladder pump
 Sampling Method Low-flow

Well Information:

Depth of Well * 7.28 ft.
 Depth to Water * 7.28 ft.
 Length of Water Column ft.
 Volume of Water in Well gal(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC
 2" Diameter Well = 0.163 X LWC
 4" Diameter Well = 0.653 X LWC

Volume removed before sampling 5 gal(s)Did well go dry? No

* Measurements taken from

☒ Well Casing☐ Protective Casing

(Other, Specify)

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes 4 or 10
 ORP Yes

Turbidity: zero Yes 200 or 250

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
<u>1235</u> initial	<u>100</u>	initial	<u>14.25</u> initial	<u>0.681</u> initial	<u>2.30</u> initial	<u>7.59</u> initial	<u>-23.4</u> initial	<u>1170</u> initial
<u>1240</u>	<u>100</u>		<u>11.65</u>	<u>0.629</u>	<u>0.79</u>	<u>7.55</u>	<u>-53.4</u>	<u>68.1</u>
<u>1245</u>	<u>100</u>	<u>7.29</u>	<u>11.39</u>	<u>0.628</u>	<u>0.62</u>	<u>7.51</u>	<u>-62.6</u>	<u>130.9</u>
<u>1250</u>	<u>100</u>	<u>7.30</u>	<u>11.38</u>	<u>0.624</u>	<u>0.59</u>	<u>7.45</u>	<u>-63.0</u>	<u>65.4</u>
<u>1255</u>	<u>100</u>	<u>7.30</u>	<u>11.16</u>	<u>0.625</u>	<u>2.75</u>	<u>7.39</u>	<u>-46.4</u>	<u>64.4</u>
<u>1300</u>	<u>100</u>	<u>7.30</u>	<u>12.90</u>	<u>0.613</u>	<u>3.52</u>	<u>7.37</u>	<u>-48.3</u>	<u>49.1</u>
<u>1305</u>	<u>100</u>	<u>7.30</u>	<u>13.96</u>	<u>0.625</u>	<u>3.17</u>	<u>7.36</u>	<u>-51.1</u>	<u>54.2</u>
<u>1310</u>	<u>100</u>	<u>7.30</u>	<u>15.02</u>	<u>0.624</u>	<u>3.46</u>	<u>7.35</u>	<u>-42.5</u>	<u>51.1</u>
<u>1315</u>	<u>100</u>	<u>7.30</u>	<u>15.94</u>	<u>0.626</u>	<u>3.38</u>	<u>7.36</u>	<u>-33.5</u>	<u>42.0</u>
<u>1320</u>	<u>100</u>	<u>7.30</u>	<u>16.58</u>	<u>0.625</u>	<u>3.29</u>	<u>7.35</u>	<u>-27.6</u>	<u>49.2</u>

Water Sample:

Time Collected 1440

Physical Appearance at Start

Color Cloudy
 Odor
 Turbidity 1170
 Sheen/Free Product

Physical Appearance at Sampling

Color Clearer
 Odor
 Turbidity 107.9
 Sheen/Free Product

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No
Metals	3005A/6010B and 7470A	1	1 L	HNO ₃	No
Cyanide (total and free)	9012A and SM 4500	1	250 ml Poly	NaOH	No

Notes:

MS/MSD

Turbidity at sampling was 37 NTU

Time	Pump Rate	Drawdown	Temp	Cond	DO	pH	ORP	Turb
1325	100	7.30	17.85	0.629	2.91	7.37	-36.5	82.0
1330	100	7.30	18.60	0.629	2.87	7.37	-14.7	76.8
1335	100	7.29	19.27	0.629	2.61	7.38	-5.4	77.1
1340	100	7.29	19.80	0.628	2.16	7.38	-18.3	206.1
1345	100	7.29	19.59	0.631	2.06	7.37	-21.9	174.6
1350	100	7.29	19.44	0.631	1.96	7.37	-19.8	178.4
1355	100	7.29	19.46	0.627	1.20	7.36	-5.0	284.1
1400	100	7.28	19.48	0.627	0.90	7.36	-10.9	470.9
1405	100	7.29	19.25	0.626	0.77	7.35	-22.7	381.9
1410	100	7.29	18.83	0.623	0.68	7.34	-39.8	236.5
1415	100	7.29	18.76	0.624	0.68	7.34	-54.1	202.8
1420	100	7.30	18.90	0.624	0.69	7.33	-59.1	152.8
1425	100	7.30	18.92	0.624	0.64	7.33	-68.1	129.1
1430	100	7.30	18.92	0.624	0.61	7.33	-69.1	112.0
1435	100	7.30	18.90	0.624	0.60	7.33	-69.3	107.9

1440 Sample

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 6/9/10
 Site Name NBA GW Delineation Study
 Location Bronson, MI
 Project No. 12718/41845.002.001
 Personnel KBS/CC

Weather Partly cloudy 70°
 Well # MW-43
 Evacuation Method Bladder pump
 Sampling Method Low-flow

Well Information:

Depth of Well * ft.
 Depth to Water * 5.94 ft.
 Length of Water Column ft.
 Volume of Water in Well gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC
 2" Diameter Well = 0.163 X LWC
 4" Diameter Well = 0.653 X LWC

Volume removed before sampling
 Did well go dry?

1/2 gal.(s)
No

* Measurements taken from

☐ Well Casing☐ Protective Casing

(Other, Specify)

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes 4 or 10
 ORP Yes

Turbidity: zero Yes 200 or 225

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
1415	initial 140	initial 5.74	initial 18.05	initial 551	initial 0.68	initial 7.51	initial -171.0	initial 32
1420		5.94	17.74	531	0.35	7.44	-149.7	9
1425		5.94	16.71	510	0.27	7.40	-128.3	5
1430		5.94	16.41	503	0.23	7.36	-110.4	5
1435		5.94	17.21	511	0.22	7.34	-98.7	5
1440		5.94	17.14	511	0.21	7.33	-91.0	5
1445		5.94	17.24	512	0.21	7.30	-88.4	6
1450	↓	5.94	17.33	513	0.20	7.30	-86.8	7

Water Sample:

Time Collected

1450

Physical Appearance at Start

Color

clear

Odor

-

Turbidity

32

Sheen/Free Product

-

Physical Appearance at Sampling

Color

clear

Odor

-

Turbidity

7

Sheen/Free Product

-

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No
Metals		1	1 L	NH ₄ OH	
Cyanide		1	250 ml	N ₂ OH	

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 6/10/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel C. Cox/K. Schneider

Weather Sunny, 70°
 Well # MW-445
 Evacuation Method Bladder pump
 Sampling Method Low-flow

Well Information:

Depth of Well * _____ ft.
 Depth to Water * 6.92 ft.
 Length of Water Column _____ ft.
 Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling 1.5 gal.(s)Did well go dry? No

* Measurements taken from

☒ Well Casing☐ Protective Casing

(Other, Specify) _____

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes 9 or 10
 ORP Yes

Turbidity: zero Yes 200 or 225

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
<u>1155</u>	initial <u>6.94</u>	initial <u>100</u>	initial <u>21.18</u>	initial <u>709</u>	initial <u>3.03</u>	initial <u>7.75</u>	initial <u>-4.7</u>	initial <u>175.6</u>
<u>1200</u>	<u>6.94</u>	<u>100</u>	<u>20.58</u>	<u>740</u>	<u>2.11</u>	<u>7.42</u>	<u>4.1</u>	<u>40.4</u>
<u>1205</u>	<u>6.94</u>	<u>100</u>	<u>18.93</u>	<u>708</u>	<u>1.12</u>	<u>7.24</u>	<u>8.9</u>	<u>13.0</u>
<u>1210</u>	<u>6.94</u>	<u>100</u>	<u>18.29</u>	<u>695</u>	<u>0.79</u>	<u>7.16</u>	<u>12.3</u>	<u>6.1</u>
<u>1215</u>	<u>6.94</u>	<u>100</u>	<u>18.17</u>	<u>692</u>	<u>0.48</u>	<u>7.15</u>	<u>12.4</u>	<u>3.4</u>
<u>1220</u>	<u>6.94</u>	<u>100</u>	<u>18.20</u>	<u>696</u>	<u>0.31</u>	<u>7.12</u>	<u>13.5</u>	<u>1.7</u>
<u>1225</u>	<u>6.95</u>	<u>100</u>	<u>18.24</u>	<u>699</u>	<u>0.28</u>	<u>7.10</u>	<u>13.7</u>	<u>1.5</u>
<u>1230</u>	<u>6.95</u>	<u>100</u>	<u>18.22</u>	<u>6.98</u>	<u>0.30</u>	<u>7.10</u>	<u>13.8</u>	<u>1.4</u>

Water Sample:

Time Collected 1235

Physical Appearance at Start

Color Cloudy
 Odor _____
 Turbidity 175.6
 Sheen/Free Product _____

Physical Appearance at Sampling

Color Clear
 Odor _____
 Turbidity 1.4
 Sheen/Free Product _____

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No
Metals	3005A/6010B and 7470A	1	1 L	NH ₄ OH	No
Cyanide (total and free)	9012A and SM 4500	1	250 ml Poly	NaOH	No

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 6/10/10 GNMW-44D
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel C. Cox/K. Schneider

Weather Sunny, 70°
 Well # MW-44D
 Evacuation Method Bladder pump
 Sampling Method Low-flow

Well Information:

Depth of Well * ft.
 Depth to Water * 5.46 ft.
 Length of Water Column ft.
 Volume of Water in Well gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling 2.5 gal.(s)Did well go dry? No

* Measurements taken from

☒ Well Casing☐ Protective Casing(Other, Specify)

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes @ or 10
 ORP Yes

Turbidity: zero Yes 200 or 225

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
<u>1255</u>	initial <u>100</u>	initial <u>5.50</u>	initial <u>20.78</u>	initial <u>760</u>	initial <u>1.71</u>	initial <u>7.15</u>	initial <u>-68.9</u>	initial <u>1030.6</u>
<u>1300</u>	<u>100</u>	<u>5.50</u>	<u>20.61</u>	<u>784</u>	<u>1.21</u>	<u>7.17</u>	<u>-96.7</u>	<u>388.7</u>
<u>1305</u>	<u>100</u>	<u>5.50</u>	<u>20.52</u>	<u>784</u>	<u>0.67</u>	<u>7.16</u>	<u>-103.4</u>	<u>260.8</u>
<u>1310</u>	<u>100</u>	<u>5.51</u>	<u>20.63</u>	<u>788</u>	<u>0.58</u>	<u>7.19</u>	<u>-108.6</u>	<u>134.7</u>
<u>1315</u>	<u>100</u>	<u>5.51</u>	<u>20.74</u>	<u>776</u>	<u>0.51</u>	<u>7.24</u>	<u>-110.9</u>	<u>82.6</u>
<u>1320</u>	<u>100</u>	<u>5.51</u>	<u>20.98</u>	<u>768</u>	<u>0.48</u>	<u>7.37</u>	<u>-115.8</u>	<u>74.9</u>
<u>1325</u>	<u>100</u>	<u>5.50</u>	<u>20.48</u>	<u>760</u>	<u>0.45</u>	<u>7.26</u>	<u>-116.1</u>	<u>65.6</u>
<u>1330</u>	<u>100</u>	<u>5.50</u>	<u>20.09</u>	<u>752</u>	<u>0.43</u>	<u>7.21</u>	<u>-119.2</u>	<u>50.8</u>
<u>1335</u>	<u>100</u>	<u>5.50</u>	<u>20.11</u>	<u>752</u>	<u>0.48</u>	<u>7.19</u>	<u>-119.8</u>	<u>39.9</u>
<u>1340</u>	<u>100</u>	<u>5.50</u>	<u>20.25</u>	<u>755</u>	<u>0.51</u>	<u>7.19</u>	<u>-121.2</u>	<u>28.6</u>

Water Sample:

Time Collected 1415

Physical Appearance at Start

Physical Appearance at Sampling

Color Cloudy
 Odor
 Turbidity 1030.6
 Sheen/Free Product

Color Clear
 Odor
 Turbidity 17.5
 Sheen/Free Product

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No
Metals		1	1 L	NH ₄ OH	
Cyanide		1	1250 ml	NaOH	

Notes:

Time	Rate	Drawdown	Temp	Cond	DO	pH	ORP	Turb
1345	100	5.50	20.30	756	0.50	7.19	-121.0	21.5
1350	100	5.50	19.21	721	0.52	7.18	-119.2	20.24 - moved cell into the shade
1355	100	5.51	17.48	710	0.50	7.16	-117.6	18.3
1400	100	5.51	17.40	708	0.47	7.17	-117.5	17.6
1405	100	5.51	17.35	705	0.48	7.16	-117.8	17.4

Sample Time 1415

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 6/9/10
 Site Name NBIA GW Definition Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel C. Cox / K. Schneider

Weather Cloudy, 70°
 Well # MW-453
 Evacuation Method Bladder pump
 Sampling Method Low-flow

Well Information:

Depth of Well * ft.
 Depth to Water * 7.39 ft.
 Length of Water Column ft.
 Volume of Water in Well gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC

2" Diameter Well = 0.163 X LWC

4" Diameter Well = 0.653 X LWC

Volume removed before sampling 1.5 gal.(s)Did well go dry? No

* Measurements taken from

☒ Well Casing☐ Protective Casing

(Other, Specify)

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes @ or 10
 ORP Yes

Turbidity: zero Yes 200 or 225

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
1405	initial 100	initial 7.38	initial 17.05	initial 0.848	initial 11.39	initial 11.23	initial 0.0	initial 234.5
1410	100	7.39	16.83	0.840	1.28	11.34	-5.5	181.6
1415	100	7.39	15.87	0.831	0.82	11.66	-6.8	133.2
1420	100	7.39	15.62	0.829	0.67	12.41	-6.1	54.5
1425	100	7.39	15.41	0.827	0.62	12.54	-3.3	18.0
1430	100	7.40	15.47	0.824	0.54	12.25	-2.3	18.3
1435	100	7.40	15.76	0.822	0.43	12.53	5.9	21.9
1440	100	7.40	15.73	0.823	0.40	13.03	11.5	11.2
1445	100	7.39	15.70	0.821	0.41	13.44	13.8	13.4
1450	100	7.40	15.71	0.819	0.39	13.58	10.7	24.3

Water Sample:

Time Collected 1415

Physical Appearance at Start

Color Rusty
 Odor
 Turbidity 234.5
 Sheen/Free Product

Physical Appearance at Sampling

Color Clear
 Odor
 Turbidity 19.1
 Sheen/Free Product

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No
Metals	3005A/6010B and 7470A	1	1 L	NHO ₃	No
Cyanide (total and free)	9012A and SM 4500	1	250 ml Poly	NaOH	No

Notes: pH was obviously off so a check was performed pH 7.0 solution read 9.5 pH 4.0 read 4.38 recalibrate
 after recalibration pH 7.0 read 6.98 and a sample from the well read 11.6
 + GWD-01 pH w/ other flow cell meter Read - 7.29

Time	Rate	Drawdown	Temp	Cond	DO	pH	ORP	Turb
1355	100	7.40	15.71	0.818	0.40	13.92	-9.1	22.1
1400	100	7.40	15.75	0.817	0.38	14.00	-18.2	14.3
1405	100	7.40	15.70	0.818	0.37	14.08	-23.1	20.8

Sample Time 1405

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 6/9/10
 Site Name NBIA GW Definition Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel C. Cox/K. Schneider

Weather Partly Cloudy, 70°
 Well # GW-W-45B
 Evacuation Method Bladder pump
 Sampling Method Low-flow

Well Information:

Depth of Well * ft.
 Depth to Water * 6.90 ft.
 Length of Water Column ft.
 Volume of Water in Well gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC
 2" Diameter Well = 0.163 X LWC
 4" Diameter Well = 0.653 X LWC

Volume removed before sampling 2.5 gal.(s)Did well go dry? No

* Measurements taken from

☐ Well Casing☒ Protective Casing(Other, Specify)

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes or 10
 ORP Yes

Turbidity: zero Yes 200 or 250

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
1555	Initial 100	Initial 6.92	Initial 27.49	initial 0.003	initial 1.20	initial 7.60	initial 64.1	initial 1092.6
1600	100	6.92	20.39	0.971	1.22	8.42	-39.6	1227.7
1605	100	6.92	19.05	0.957	0.50	11.19	-68.5	1219.5
1610	100	6.93	18.15	0.944	2.39	11.41	-74.5	946.6
1615	100	6.93	18.14	0.935	1.07	11.11	-81.6	658.3
1620	100	6.93	18.04	0.931	0.53	11.10	-84.6	448.8
1625	100	6.93	18.03	0.926	0.49	11.38	-87.5	236.7
1630	100	6.93	18.02	0.921	0.46	11.53	-93.9	157.3
1635	100	6.93	17.80	0.921	0.45	11.82	-95.6	103.2
1640	100	6.93	17.69	0.920	0.47	11.46	-95.2	102.9

Water Sample:

Time Collected 1725

Physical Appearance at Start

Color Brown / Cloudy
 Odor
 Turbidity 1092.6
 Sheen/Free Product

Physical Appearance at Sampling

Color Clear
 Odor
 Turbidity 45
 Sheen/Free Product

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No
Metals	3005A/6010B and 7470A	1	1 L	NHO ₃	No
Cyanide (total and free)	9012A and SM 4500	1	250 ml Poly	NaOH	No

Notes:

pH w/ other flow cell meter read - 7.25

Time	Rate	Drawdown	Temp	Cond	DO	pH	ORP	Turb
1645	100	6.92	17.37	0.918	0.45	11.68	-97.7	100.4
1650	100	6.92	17.41	0.914	0.47	11.83	-96.6	94.5
1655	100	6.92	17.54	0.914	0.45	11.55	-96.7	80.1
1700	100	6.92	17.55	0.916	0.46	11.54	-96.5	50.2
1705	100	6.92	17.58	0.915	0.47	11.48	-93.6	56.4
1710	100	6.92	17.48	0.916	0.48	11.55	-95.4	46.5
1715	100	6.92	17.47	0.915	0.49	11.51	-95.7	48.1

Sample Time: 1725

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 6/9/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel KBS/cc

Weather cloudy 70°P
 Well # MW-4C6
 Evacuation Method Bladder pump
 Sampling Method Low-flow

Well Information:

Depth of Well * 5.79 ft.
 Depth to Water * 5.79 ft.
 Length of Water Column ft.
 Volume of Water in Well gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC
 2" Diameter Well = 0.163 X LWC
 4" Diameter Well = 0.653 X LWC

Volume removed before sampling

4 gal.(s)

Did well go dry?

No

* Measurements taken from

☐ Well Casing☐ Protective Casing

(Other, Specify)

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes or 10 Yes
 ORP Yes

Turbidity: zero Yes 200 or 225

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
1055	initial 160	initial 5.81	initial 15.32	initial 613	initial 0.28	initial 6.57	initial -18.1	initial 1014
1100		5.81	15.35	614	0.62	6.75	-82.7	647
1105		5.81	15.30	614	0.41	6.84	-95.7	410
1110		5.81	15.30	614	0.300	6.91	-102.2	313
1115		5.81	15.19	612	0.31	6.96	-105.9	224
1120		5.81	14.57	605	0.30	6.98	-106.7	173
1125		5.81	14.92	608	0.28	7.00	-106.6	138
1130		5.81	15.01	610	0.27	7.03	-107.7	120
1135		5.81	14.98	609	0.28	7.06	-107.9	106
1140		5.81	14.71	605	0.26	7.07	-107.5	89
1145		5.81	14.74	605	0.25	7.04	-106.2	9

Water Sample:

Time Collected 1235

Physical Appearance at Start

Color cloudy
 Odor
 Turbidity 1014
 Sheen/Free Product

Physical Appearance at Sampling

Color clear
 Odor
 Turbidity 30
 Sheen/Free Product

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No
Metals		1	1 L	NH ₄ OH	
Cyanide		1	250 ml	NaOH	

Notes:

Time	Pump	DO	Temp	Con	DO	pH	ORP	Turb
1150	660	5.81	15.02	609	0.25	7.06	-106.2	85
1155		5.81	15.08	611	0.23	7.09	-107.1	71
1200		5.81	15.25	612	0.23	7.09	-108.0	72
1205		5.81	15.30	614	0.23	7.11	-108.7	59
1210		5.81	14.86	608	0.23	7.10	-106.8	55
1215		5.81	14.95	609	0.21	7.09	-105.8	46
1220		5.81	15.14	612	0.22	7.09	-108.0	41
1225		5.81	15.17	612	0.22	7.10	-105.9	38
1230		5.81	15.15	612	0.22	7.11	-105.6	40
1235		5.51	15.12	612	0.22	7.11	-105.7	36

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 6/8/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel KSS/CC

Weather cloudy PM Rain 70s
 Well # MW-47
 Evacuation Method Bladder pump
 Sampling Method Low-flow

Well Information:

Depth of Well * ft.
 Depth to Water * 6.24 ft.
 Length of Water Column ft.
 Volume of Water in Well gal.(s)

Water Volume /ft. for:
 1" Diameter Well = 0.041 X LWC
 2" Diameter Well = 0.163 X LWC
 4" Diameter Well = 0.653 X LWC

Volume removed before sampling 2.5 gal.(s)
 Did well go dry? No

* Measurements taken from

☐ Well Casing☐ Protective Casing(Other, Specify)

Instrument Calibration:

Calibrated within Range

Conductivity yes
 DO yes
 pH: 7 yes 4 or 10
 ORP yes

Turbidity: zero yes 200 or 225

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
1300	initial 140	initial 6.28	initial 16.57	initial 719	initial 5.35	initial 7.64	initial -5.6	initial 1100
1305		6.28	14.71	689	0.70	7.39	-79.1	1100
1310		6.28	14.19	681	0.40	7.31	-85.9	1100
1315		6.28	13.83	675	0.28	7.26	-90.6	892
1320		6.28	13.67	672	0.28	7.24	-95.2	296
1325		6.28	13.39	666	0.22	7.22	-99.7	136
1330		6.28	13.41	666	0.22	7.22	-100.8	103
1335		6.28	13.25	665	0.23	7.23	-101.9	81
1340		6.28	12.74	658	0.21	7.20	-101.6	52
1345		6.28	13.42	665	0.20	7.23	-104.7	41
1350		6.28	13.54	668	0.21	7.26	-106.5	32

Water Sample:

Time Collected 1405

Physical Appearance at Start

Color cloudyOdor Turbidity 1100Sheen/Free Product

Physical Appearance at Sampling

Color clearOdor Turbidity 24Sheen/Free Product

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No
Metals		1	1 L	NH ₄ OH	
Cyanide (total and free)		1	250 ml	NaOH	

Notes:

Time	pump	DD	temp	Con	DO	pH	ORP	Turb
1355	140	6.28	13.51	668	0.21	7.26	-105.8	27
1406	↓	6.28	13.52	668	0.20	7.24	-105.5	26
1405	↓	6.28	13.39	666	0.19	7.23	-104.9	24

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 6/8/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel KES/CC

Weather Cloudy, PM Rain 70°
 Well # MW-48
 Evacuation Method Bladder pump
 Sampling Method Low-flow

Well Information:

Depth of Well * ft.
 Depth to Water * 6.11 ft.
 Length of Water Column ft.
 Volume of Water in Well gal(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC
 2" Diameter Well = 0.163 X LWC
 4" Diameter Well = 0.653 X LWC

Volume removed before sampling 2 gal(s)Did well go dry? NO(Other, Specify)

* Measurements taken from

☐ Well Casing☐ Protective Casing

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes 4 or 10 Yes
 ORP Yes

Turbidity: zero Yes 200 or 225

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
1055	initial 160	initial 6.11	initial 14.09	initial 542	initial 1.64	initial 7.42	initial 135.5	initial 143
1100		6.11	13.16	529	0.52	7.20	4.6	108
1105		6.11	12.90	525	0.30	7.14	-20.0	79
1110		6.11	12.82	524	0.23	7.12	-31.3	57
1115		6.11	12.70	521	0.21	7.10	-36.7	40
1120		6.11	12.10	515	0.18	7.08	-42.3	26
1125		6.11	12.13	513	0.18	7.08	-44.9	16
1130		6.11	12.27	515	0.19	7.09	-47.2	9
1135	↓	6.11	12.35	516	0.17	7.07	-47.8	6

Water Sample:

Time Collected 1135

Physical Appearance at Start

Color Slightly cloudy
 Odor
 Turbidity 143
 Sheen/Free Product

Physical Appearance at Sampling

Color clear
 Odor
 Turbidity 6
 Sheen/Free Product

Samples collected:

Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No
Metals		1	1L	NH ₄ OH	
Cyanide		1	250 ml	NaOH	

Notes:

O'Brien & Gere Engineers, Inc.

Ground Water Sampling Log

Date 6/8/10
 Site Name NBIA GW Delineation Study
 Location Bronson, MI
 Project No. 12716/41845.002.001
 Personnel C. Cox / K. Schneider
 Weather Cloudy, PM Rain, 70°
 Well # SW/MW-49
 Evacuation Method Bladder pump
 Sampling Method Low-flow

Well Information:

Depth of Well * ft.
 Depth to Water * 3.98 ft.
 Length of Water Column ft.
 Volume of Water in Well gal.(s)

Water Volume /ft. for:

1" Diameter Well = 0.041 X LWC
 2" Diameter Well = 0.163 X LWC
 4" Diameter Well = 0.653 X LWC

Volume removed before sampling 3 gal.(s)Did well go dry? No

* Measurements taken from

☒ Well Casing☐ Protective Casing(Other, Specify)

Instrument Calibration:

Calibrated within Range

Conductivity Yes
 DO Yes
 pH: 7 Yes @ or 10
 ORP Yes

Turbidity: zero 100 200 or 250

Water parameters:

Time	Pumping Rate (ml/min.)	Drawdown (ft)	Temperature (Celsius)	Conductivity (uS/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity (NTUs)
<u>1025</u>	initial <u>100</u>	initial <u>4.03</u>	initial <u>19.59</u>	initial <u>0.013</u>	initial <u>5.46</u>	initial <u>9.59</u>	initial <u>93.6</u>	initial <u>121.3</u>
<u>1030</u>	<u>100</u>	<u>4.03</u>	<u>17.88</u>	<u>0.585</u>	<u>2.21</u>	<u>9.72</u>	<u>73.7</u>	<u>1205.0</u>
<u>1035</u>	<u>100</u>	<u>Empty thru pump cell due to silt buildup.</u>						
<u>1040</u>	<u>100</u>	<u>4.03</u>	<u>22.22</u>	<u>0.580</u>	<u>3.01</u>	<u>9.24</u>	<u>131.8</u>	<u>185.4</u>
<u>1045</u>	<u>100</u>	<u>4.03</u>	<u>17.62</u>	<u>0.698</u>	<u>1.82</u>	<u>8.19</u>	<u>97.0</u>	<u>187.4</u>
<u>1050</u>	<u>100</u>	<u>4.03</u>	<u>17.66</u>	<u>0.914</u>	<u>0.97</u>	<u>8.04</u>	<u>50.0</u>	<u>195.3</u>
<u>1055</u>	<u>100</u>	<u>4.03</u>	<u>17.63</u>	<u>0.934</u>	<u>0.91</u>	<u>7.99</u>	<u>-15.6</u>	<u>166.3</u>
<u>1100</u>	<u>100</u>	<u>4.03</u>	<u>17.57</u>	<u>0.945</u>	<u>0.86</u>	<u>7.94</u>	<u>-52.2</u>	<u>169.7</u>
<u>1105</u>	<u>100</u>	<u>4.03</u>	<u>17.49</u>	<u>0.971</u>	<u>0.76</u>	<u>7.88</u>	<u>-64.5</u>	<u>186.4</u>
<u>1110</u>	<u>100</u>	<u>4.03</u>	<u>17.18</u>	<u>0.971</u>	<u>0.68</u>	<u>7.83</u>	<u>-79.2</u>	<u>171.9</u>

Water Sample:

Time Collected 1200

Physical Appearance at Start

Color Cloudy
 Odor
 Turbidity 121.3
 Sheen/Free Product

Physical Appearance at Sampling

Color Clear
 Odor
 Turbidity 45.1
 Sheen/Free Product

Samples collected:

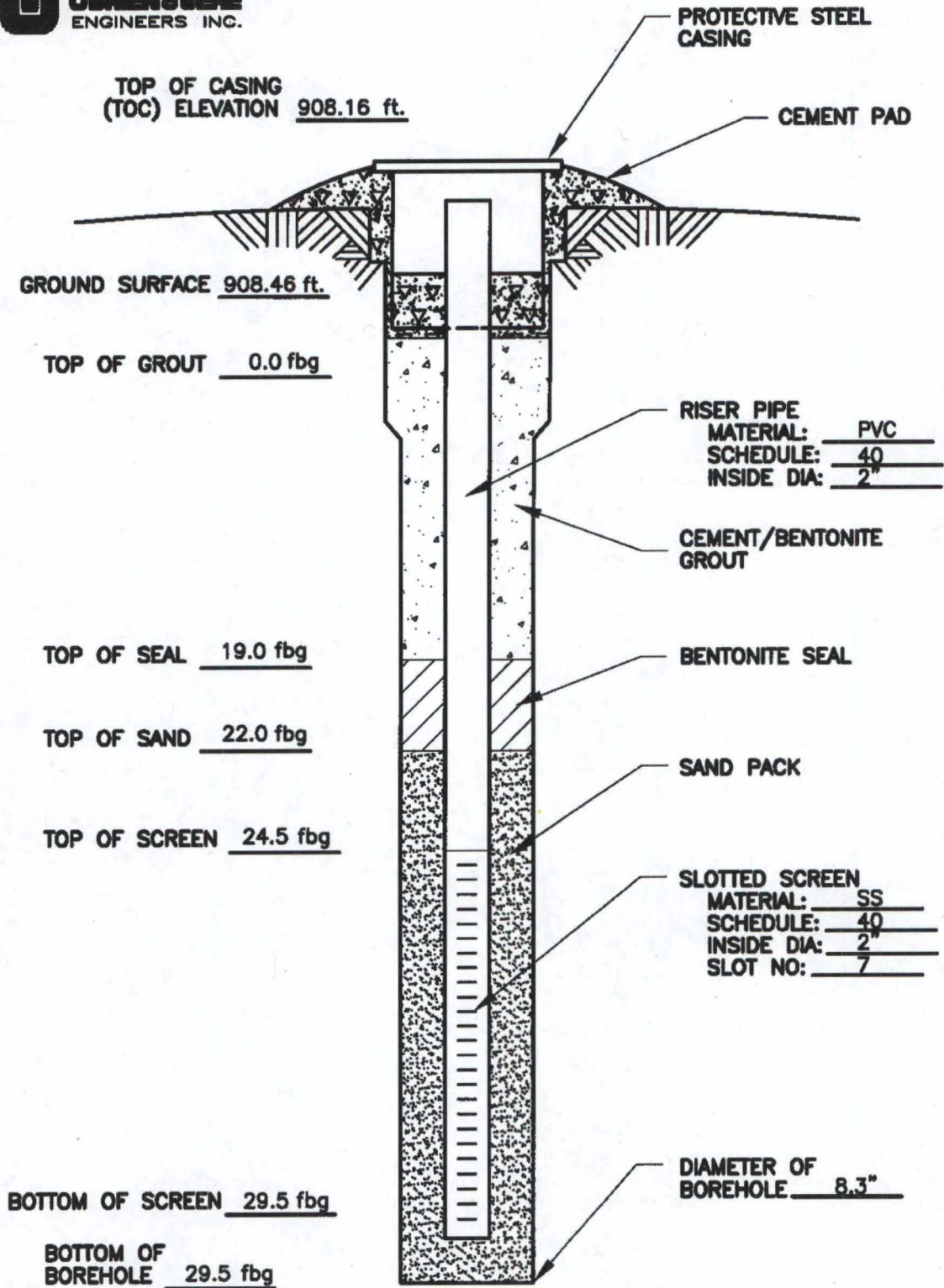
Analyses	Method	# Bottles	Bottle Size/Type	Preservative	Field Filtered
VOCs	5030B/8260B	3	40 ml vials	HCL	No
Metals	3005A/6010B and 7470A	1	1 L	NHO ₃	No
Cyanide (total and free)	9012A and SM 4500	1	250 ml Poly	NaOH	No

Notes:

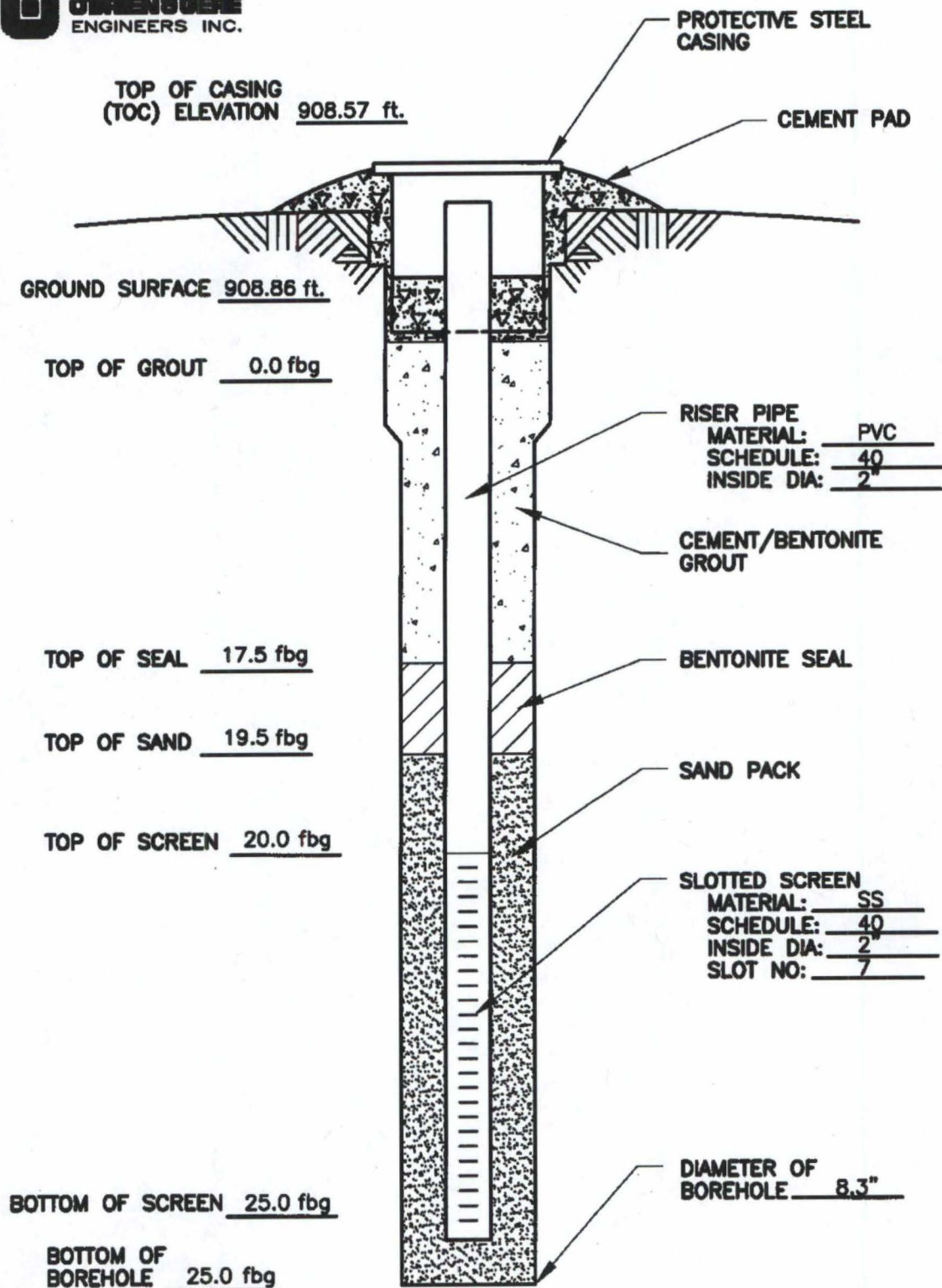
Time	Rate	Drawdown	Temp	Cond	DO	pH	ORP	Turb
1115	100	4.03	17.14	0.975	0.91	7.77	-63.9	115.8
1120	100	4.03	16.86	0.986	0.77	7.71	-70.2	101.2
1125	100	4.03	16.46	0.999	0.62	7.64	-81.4	90.4
1130	100	4.03	16.13	1.000	0.57	7.62	-89.0	81.4
1135	100	4.03	16.11	0.997	0.52	7.59	-92.3	72.6
1140	100	4.03	16.07	0.999	0.49	7.57	-94.3	50.9
1145	100	4.03	16.12	0.998	0.48	7.56	-94.9	46.0
1150	100	4.03	16.07	0.999	0.49	7.55	-94.7	45.1

Sample: 1200

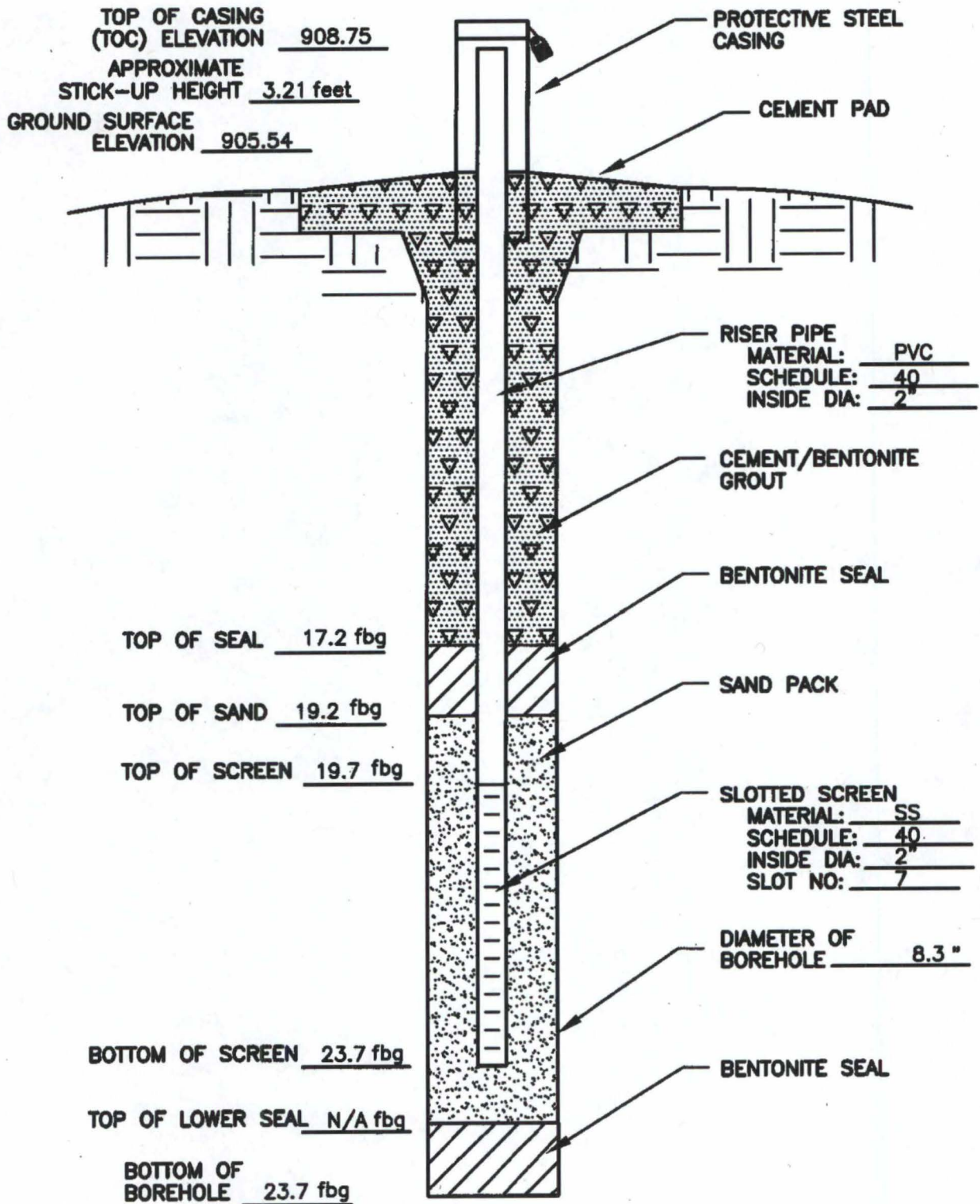
Appendix D
Monitoring Well
Construction Logs



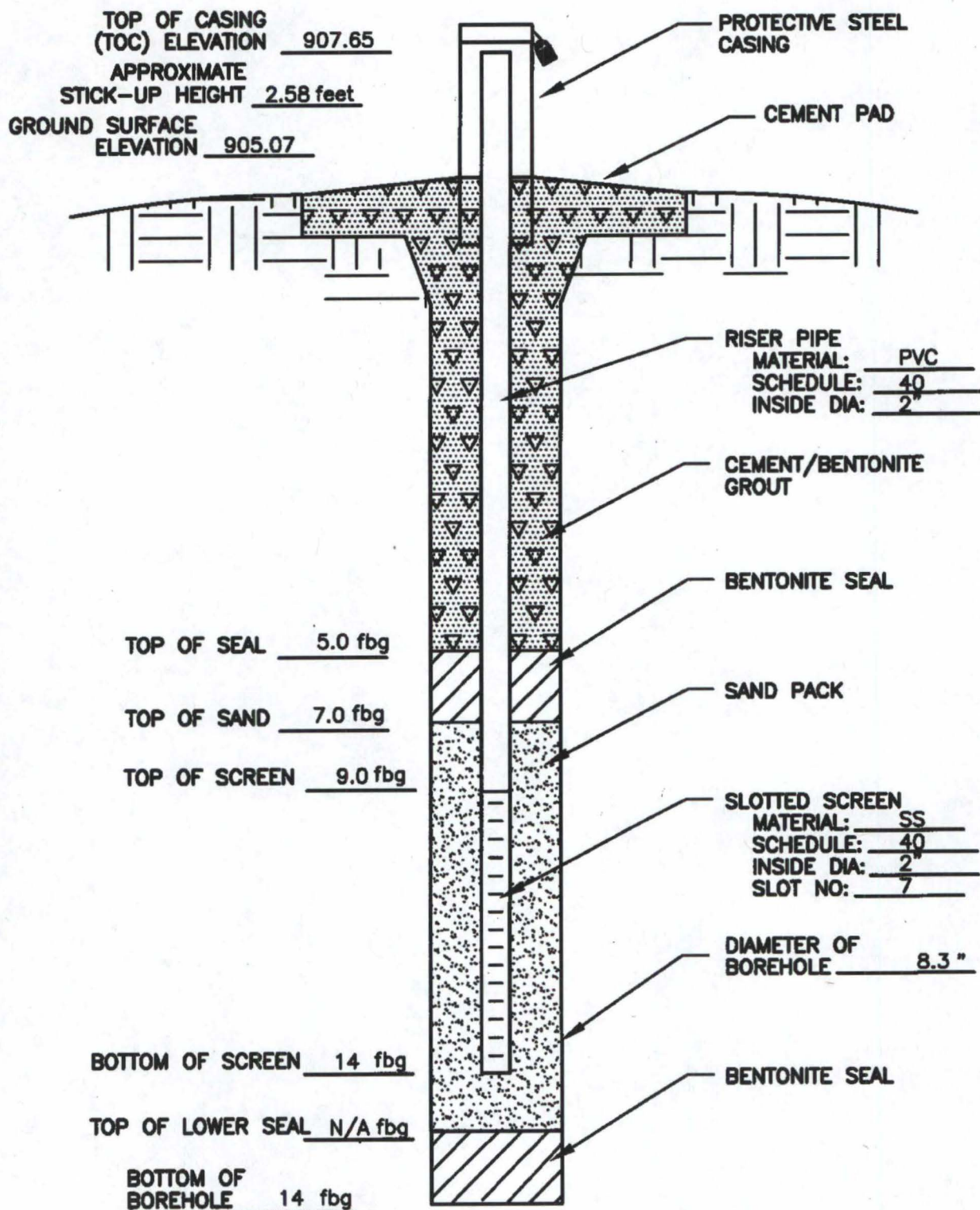
NBIA GW Delineation Study
Bronson, MICHIGAN
MONITORING WELL 41



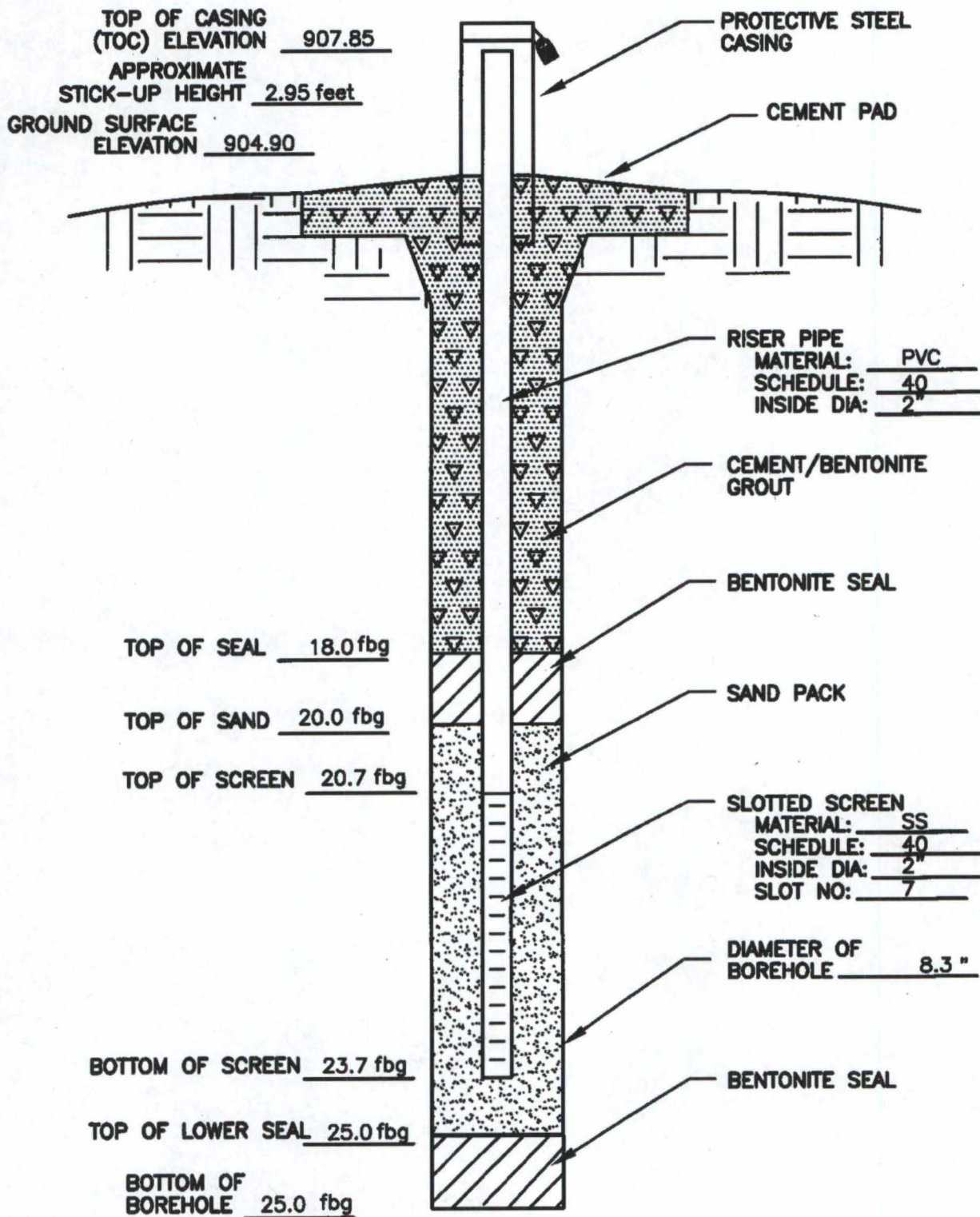
**NBIA GW Delineation Study
Bronson, MICHIGAN
MONITORING WELL 46**



NBIA GW Delin. Study
Bronson, MICHIGAN
MONITORING WELL 47



NBIA GW Delin. Study
Bronson, MICHIGAN
MONITORING WELL 48



**NBIA GW Delin. Study
Bronson, MICHIGAN
MONITORING WELL 49**

Appendix E

Well Development Logs



O'BRIEN & GERE
ENGINEERS, INC.

WELL DEVELOPMENT LOG

Well ID: 41

Date 5/12/10 ~~12008~~
Site Name NBIA GW Delin. Study
Site Location Bronson, MI

Field Personnel _____
Contractor Stearns Drilling Co.
Evacuation Method Monsoon pump

Weather cloudy 50°F
Project No. 41845.002.001

Well Information:

Depth to Bottom (Initial)* 29.5 ft. Date(s) Installed 5/12/10 ~~12008~~ Date(s) Developed 5/12/10 ~~12008~~
Depth to Bottom (Final)* 29.5 ft. Driller Jerry Huntman Development Time Start: 1000
Depth to Water (Initial)* 11.52 ft. Well Diameter 2 in. Stop: 1400
Depth to Water (Final)* 2.45 ft. Casing Volume _____ gal. Total: 4 hrs

* Measuring point TOC 3.2 Pump setting* _____ ft.
(intake)

Elapsed Time	Volume of Water Removed (Gallons)	Temperature °C	pH s.u	Conductivity mS/cm	Turbidity (NTU)	Approximate Flow Rate (gal/min)	Depth to Water (ft.)	Appearance of Water
	N/A	Surged with surge block			21000	0		cloudy
10		11.69	7.06	579	21000	2	9.80	" "
20		11.45	7.07	577	585	2		" "
30	50	11.28	7.13	575	333	1-2	9.68	" "
40		11.28	7.12	573	115	1-2		slightly cloudy
50		11.27	7.24	575	159	1	9.62	" "
60		11.25	7.18	581	106	1		" "
70		11.23	7.23	581	256	0.25	9.06	" "
80	100	11.81	7.28	589	125	0.25		" "
90		11.89	7.32	591	98	0.5		" "
100		11.29	7.19	573	57	0.5	9.45	" "
110		11.29	7.18	575	36	0.5		clear
120		11.28	7.19	577	24	0.5		" "
130		11.26	7.20	576	28	0.5	9.40	" "
140	150	11.27	7.20	575	26	0.5		" "
150	165	11.28	7.22	577	24	0.5		" "

Note: Following development use the extra rows in the table above to monitor the ground water recovery, if possible to within 10% of initial DTW

Development Water Characteristics:

Total volume of Development water removed: 165

Physical appearance at start

FID 0
Color cloudy
Odor no
Sheen/Free Product No

Physical appearance at end

FID 0
Color cloud
Odor no
Sheen/Free Product No

NOTES:

Ka phase of pump disconnected at 130 min
Surged w/ surge block periodically during development
3 H₂O drums
2 soil drums
Geologist Signature: _____

WELL DEVELOPMENT LOG

 Well ID: **46**

Date: 5/13/2008 Field Personnel: _____ Weather: cloudy 45°F
 Site Name: NBIA GW Delin. Study Contractor: Stearns Drilling Co. Project No.: 41845.002.001
 Site Location: Bronson, MI Evacuation Method: Monsoon Pump

Well Information: 35' - Shuckup
 Depth to Bottom (Initial)*: 27.75 ft. Date(s) Installed: 1/2008 Date(s) Developed: 5/13/10
 Depth to Bottom (Final)*: 27.75 ft. Driller: Jerry Norton Development Time: Start: 9:15
 Depth to Water (Initial)*: 9.49 ft. Well Diameter: 2 in. Stop: 13:15
 Depth to Water (Final)*: 9.33 ft. Casing Volume: _____ gal. Total: 4 hrs

* Measuring point TOC 3' Shuckup Pump setting* _____ ft.
 (intake)

Elapsed Time	Volume of Water Removed (Gallons)	Temperature °C	pH s.u	Conductivity mS/cm	Turbidity (NTU)	Approximate Flow Rate (gal/min)	Depth to Water (ft.)	Appearance of Water
15	N/A	Surged with surge block			71000	2	9.81	cloudy
30			5.86	545	71000	2		" "
45		10.88	6.09	542	974	1	9.69	" "
60	50	10.88	6.67	541	718	1	9.69	" "
75		10.87	6.87	538	512	1	9.69	" "
90		10.88	6.86	538	233	1	9.69	" "
105		10.90	7.05	542	194	0.5-1	9.75	Slightly cloudy
120		10.89	6.98	542	106	0.5-1	9.75	" "
135	100	10.92	7.12	542	108	0.5-1	9.75	" "
150		10.94	7.09	542	84	0.5-1	9.75	" "
165		10.94	7.05	542	74	0.5-1	9.60	" "
180		10.94	7.05	541	68	0.5-1	9.60	" "
195	150	10.96	7.07	541	64	0.5-1	9.71	" "
210		10.98	7.09	542	55	0.5-1	9.60	clear
225		11.00	7.13	543	41	0.5-1	9.60	" "
240	190	11.01	7.10	543	42	0.5-1	9.60	" "

Note: Following development use the extra rows in the table above to monitor the ground water recovery, if possible to within 10% of initial DTW

Development Water Characteristics:

 Total volume of Development water removed: 190

Physical appearance at start

FID: 0
 Color: cloudy
 Odor: no
 Sheen/Free Product: no

Physical appearance at end

FID: 0
 Color: clear
 Odor: no
 Sheen/Free Product: no

NOTES:

Surged periodically w/ surge block during development

Soil - 1 drum 2 bags sand 1 bag chip 4 bags cement
 H₂O - 3 3/4 drums Geologist Signature: _____

Date 5/13/10 /2008
Site Name NBIA GW Delin. Study
Site Location Bronson, MI

Field Personnel	
Contractor	Stearns Drilling Co.
Evacuation Method	Monsoon Pump

Weather cloudy 60°F
Project No. 41845.002.001

Well information:

Depth to Bottom (Initial) * 16.90 - 14' ft.
Depth to Bottom (Final)* 16.90 - 14' ft.
Depth to Water (Initial)* 6.54 6.38 ft.
Depth to Water (Final)* 6.31 6.31 ft.

Date(s) Installed	1 / 2008
Driller	Jeremy Hinton
Well Diameter	2 in.
Casing Volume	gal.

Date(s) Developed 1/2008
Development Time
Start: 1545 745
Stop: 1700 900
Total: 3 hrs

* Measuring point TOC 2.9 Pump setting* ft.
(intake)

Elapsed Time	Volume of Water Removed (Gallons)	Temperature °C	pH s.u	Conductivity mS/cm	Turbidity (NTU)	Approximate Flow Rate (gal/min)	Depth to Water (ft.)	Appearance of Water
0	N/A	Surged with surge block			>1000	2-3	6.56	cloudy
5	50	13.47	6.63	576	365	2-3	6.56	cloudy
10		10.35	7.09	526	152	2-3	6.56	Slightly cloudy
15		10.19	6.97	523	146	1	6.56	" "
20	100	10.34	7.05	526	97	1	6.42	" "
25		10.43	7.02	527	64	1	6.42	" "
30		10.36	7.07	527	47	1	6.42	clear
35		9.06	7.27	523	23	1	6.40	" "
40	150	9.06	7.28	513	30	1	6.36	" "
45		9.02	7.06	512	40	1	6.36	" "
50		9.08	7.01	511	26	1	6.36	" "
55	190	9.09	6.99	510	15	1	6.36	" "
60								
65								
70								
75								
80								
85								
90								
95								
100								

Note: Following development use the extra rows in the table above to monitor the ground water recovery, if possible to within 10% of initial DTW

Development Water Characteristics:

Total volume of Development water removed: 90

Physical appearance at start

FID	0
Color	cloudy
Odor	NO
product	NO

Physical appearance at end

FID	0
Color	Clear
Odor	No
Product	N ₂

Sheen/Free Product

Sheen/Free Product

NOTES: Surged w/ surge block periodically during development

1 soil drum
2 3/4 water drums

Geologist Signature:

Date 5/17/10 + ~~12000~~
Site Name NBIA GW Delin. Study
Site Location Bronson, MI

Field Personnel	
Contractor	Stearns Drilling Co.
Evacuation Method	

Weather _____

Project No. 41845.002.001

Well information:

Depth to Bottom (Initial) *	<u>23.8</u>	ft.
Depth to Bottom (Final)*	<u>23.7</u>	ft.
Depth to Water (Initial)*	<u>4.59</u>	ft.
Depth to Water (Final)*	<u>5.03</u>	ft.

5/17/10
Date(s) Installed ~~12008~~
Driller Jerry huntton
Well Diameter 2 in.
Casing Volume gal.

5/17/10
Date(s) Developed ~~1-12006~~
Development Time
Start: 930
Stop: 1600
Total: 6 1/2 hrs

* Measuring point TOC 3.1 Pump setting* ft.
(Intake)

[illegible]

Note: Following development use the extra rows in the table above to monitor the ground water recovery, if possible to within 10% of initial DTW

Development Water Characteristics:

Total volume of Development water removed: 165

Physical appearance at start

FID	0
Color	cloudy
Odor	No

Sheen/Free Product *NO*

Physical appearance at end

FID	0
Color	clear
Odor	NO

Sheen/Free Product *NO*

NOTES:

Well pumped dry after 30 min of development. Surged more and reduced flow rate. * Well would not sustain flow continued to surge w/ surge block then pump till dry, let recharge and continue.
At 5 hrs and 45 min DTU rose and pump could sustain flow continued to surge w/ surge block and purge

4 had drums
1 soil drum

Geologist Signature:

Appendix F
Analytical Laboratory
Reports and Chain-of-
Custody Forms (CD

attached)

Appendix G
Data Validation Report

TO: C Yantz
FROM: KA Storne
RE: North Bronson Industrial Area, Bronson, Michigan, GW Data Validation Report
FILE: 12716/41845.007.002
DATE: July 29, 2010

This report presents the results of data validation performed for groundwater samples collected as part of the North Bronson Industrial Area (NBIA) Site in Bronson, Michigan. Sample collection activities were conducted by O'Brien & Gere in June 2010.

TestAmerica Laboratories, Inc. of North Canton, Ohio (TA North Canton) performed the laboratory analyses for this sampling event. The laboratory packages generated contained summary forms for quality control analysis and supportive raw data.

Table 1 below summarizes the sample analyses submitted for data validation.

Table 1. Analytical methods and references		
Parameter	Method	Reference
VOCs	USEPA Method 5030B/8260B	1
Metals	USEPA Method 3005A/6010B	1
Mercury	USEPA Method 7470A	1
Total Cyanide	USEPA Method 9012A	1
Weak Acid Dissociable Cyanide	SM18 4500-CN-I	2
Note: VOC indicates volatile organic compounds.		
1. United States Environmental Protection Agency (USEPA). 2004. <i>Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846</i> , 3rd Edition, Update IIIB. Washington D.C. 2. American Water Works Association (AWWA), American Public Health Association (APHA) and Water Environment Federation (WEF). 1992. <i>Standard Methods for the Examination of Water and Wastewater</i> , 18th Edition. Washington, D.C.		

The samples submitted for data validation are summarized in the attached Table 2. Table 3 presents the specific data validation approach applied to data generated for this investigation. Table 4 presents the Laboratory QA/QC analyses definitions.

Full validation was performed on the groundwater samples collected for this investigation. The analytical data generated for this investigation were evaluated by O'Brien & Gere using the quality assurance/quality control (QA/QC) criteria established in the following documents:

- O'Brien & Gere. 2008. *Field Sampling and Quality Assurance Plan, Revision 2, Addendum 4, North Bronson Industrial Area Operable Unit 1, Bronson, Michigan*. Farmington Hills, Michigan.
- USEPA. 2004. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846*, 3rd Edition, Update IIIB. Washington, D.C.
- AWWA, APHA and WEF. 1992. *Standard Methods for the Examination of Water and Wastewater*, 18th Edition. Washington, D.C.

JULY 28, 2010
PAGE 2

Data affected by excursions from criteria presented in the methods and the QAPP are qualified using guidance provided in the following document and professional judgment:

- USEPA. 2004. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540/R-04-004*. Washington D.C.
- USEPA. 1999. *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA-540/R-99-008*. Washington D.C.

The application of these validation guidelines has been modified to reflect the requirements of the methods and the QAPP.

The data validation included an evaluation of the following parameters, where applicable:

- Chain-of-custody records
- Documentation completeness
- Sample collection and preservation
- Holding times
- Blank analysis
- Calibrations
- Gas chromatography/mass spectrometry (GC/MS) instrument check
- Surrogate recoveries
- Matrix spike/matrix spike duplicate (MS/MSD) analysis
- Laboratory control sample (LCS) analysis
- Laboratory duplicate analysis
- Internal standards performance
- Field duplicate analysis
- Inductively coupled plasma (ICP) interference check analysis
- ICP serial dilution analysis
- Target analyte quantification and quantitation limits (QLs)

The following sections of this memorandum present the results of the comparison of the analytical data to the QA/QC criteria specified above.

Chain-of-custody record

The chain-of-custody records associated with samples collected 6/7/10, 6/8/10, 6/9/10, and 6/10/10 were incomplete. The Federal Express courier and air bill numbers were not documented on the records.

Documentation completeness

Supplemental information was requested during data validation. This information was necessary to complete the validation process.

JULY 28, 2010

PAGE 3

VOC DATA EVALUATION SUMMARY

The following QA/QC parameters were found to meet method and validation criteria or did not result in additional qualification of sample results:

- Sample collection and preservation
- Holding times
- GC/MS instrument check
- Surrogate recoveries
- Internal standards performance
- Field duplicate analysis
- Target analyte identification

Excursions and additional observations are described below.

I. Calibrations

The following results were qualified as approximate (UJ) due to minor calibration accuracy excursions:

- The results for dichlorodifluoromethane in samples GMMW-46, GMMW-41, GWDUP-01 [GMMW-45S], GMMW-45S, GMMW-43, GWEB-01 and GWTB-02.
- The results for carbon disulfide in samples GWEB-02, GMMW-6D, GWDUP-01 [GMMW-6D], GMMW-33I, GMMW-44S, GMMW-44D, GWTB-03 and GMMW-45D.

II. Blank analysis

The following results were qualified as non-detected (U) due to minor blank representativeness excursions:

- The result for acetone in samples GMMW-49, GMMW-41, GMMW-45S and GMMW-44S.

III. MS/MSD analysis

The following results were qualified as approximate (UJ) due to minor MS/MSD accuracy excursions:

- The results for 2-hexanone and dichlorodifluoromethane in the un-spiked sample GMMW-42.

IV. LCS analysis

The following results were qualified as approximate (UJ) due to minor LCS accuracy excursions:

- The results for dibromochloromethane, bromoform, and dichlorodifluoromethane in samples GMMW-42, GMMW-40, GMMW-39, GMMW-48, GMMW-49, GMMW-47 and GWTB-01
- The results for dichlorodifluoromethane in samples GMMW-46, GMMW-41, GWDUP-01 [GMMW-45S], GMMW-45S, GMMW-43, GWEB-01 and GWTB-02.

V. Target analyte quantitation and QLS

JULY 28, 2010
PAGE 4

Results for VOCs with concentrations greater than the MDL but less than the QL were qualified as approximate (J) by the laboratory. The "J" qualifiers were retained during the validation process to indicate that these concentrations are approximate.

Dilutions were performed for VOC samples due to high concentrations of target analytes.

METALS DATA EVALUATION SUMMARY

The following QA/QC parameters were found to meet method and validation criteria or did not result in additional qualification of sample results:

- Sample collection and preservation
- Holding times
- Calibrations
- LCS analysis
- Laboratory duplicate analysis
- Internal standards performance
- Field duplicate analysis
- ICP interference check analysis
- ICP serial dilution analysis

Excursions and additional observations are described below.

I. Blank analysis

Results in the following samples were qualified as non-detected (U) due to minor blank excursions:

- The results for zinc in samples GWMW-40, GWMW-39, GWMW-49, GWMW-47, GWMW-46, GWMW-41, GWDUP-01 [GWMW-45S], GWMW-6D and GWDUP-01 [GWMW-6D].
- The results for thallium in samples GWMW-6D, GWDUP-01 [GWMW-6D], and GWMW-45D
- The result for barium in sample GWMW-6D.
- The results for vanadium in samples GWMW-6D, and GWDUP-01 [GWMW-6D].

Results in the following samples were qualified as approximate (UJ) due to minor blank excursions:

- The results for aluminum in samples GWDUP-01 [GWMW-45S], GWMW-45S, and GWMW-43.
- The results for cadmium in samples GWMW-46, GWMW-41, GWDUP-01 [GWMW-45S], GWMW-45S, and GWMW-43.
- The result for copper in sample GWMW-41.

II. MS and MSD analysis

Results in the following samples were qualified as approximate (J) due to minor MS/MSD precision excursions:

- The results for total cyanide in samples GWMW-40, GWMW-48, and GWMW-6D.

III. Target analyte quantitation and QLs

Metal results were reported to the QL. Results that were less than the QL but greater than the MDL, were reported by the laboratory using the "B" flag, which was revised during data validation to a "J" flag to indicate that these values are approximate.

JULY 28, 2010
PAGE 5

DATA USABILITY

Overall data usability with respect to completeness for the sample results reported is 100 percent considering the complete data set for the organic and inorganic results. The data were identified as usable for qualitative and quantitative purposes. Based on the validation performed, the completeness goal of 95 percent was met for these analyses.

Table 2. Sample cross reference list

Laboratory	Date Collected	Lab ID	Client ID	Matrix	Analysis Requested
TA North Canton	6/7/2010	AOF090543-001	GWMW-42, MS/MSD	Groundwater	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
TA North Canton	6/8/2010	AOF090543-002	GWMW-40	Groundwater	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
TA North Canton	6/8/2010	AOF090543-003	GWMW-39	Groundwater	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
TA North Canton	6/8/2010	AOF090543-004	GWMW-48	Groundwater	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
TA North Canton	6/8/2010	AOF090543-005	GWMW-49	Groundwater	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
TA North Canton	6/8/2010	AOF090543-006	GWMW-47	Groundwater	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
TA North Canton	6/8/2010	AOF090543-007	GWTB-01	Aqueous	VOCs
TA North Canton	6/9/2010	AOF100502-001	GWMW-46	Groundwater	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
TA North Canton	6/9/2010	AOF100502-002	GWMW-41	Groundwater	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
TA North Canton	6/9/2010	AOF100502-003	GWDUP-01 [GWMW-45S]	Groundwater	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
TA North Canton	6/9/2010	AOF100502-004	GWMW-45S	Groundwater	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
TA North Canton	6/9/2010	AOF100502-005	GWMW-43	Groundwater	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
TA North Canton	6/9/2010	AOF100502-006	GWEB-01	Aqueous	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
TA North Canton	6/9/2010	AOF100502-007	GWTB-02	Aqueous	VOCs
TA North Canton	6/10/2010	AOF110481-001	GWEB-02	Aqueous	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
TA North Canton	6/10/2010	AOF110481-002	GWMW-6D	Groundwater	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
TA North Canton	6/10/2010	AOF110481-003	GWDUP-01 [GWMW-6D]	Groundwater	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
TA North Canton	6/10/2010	AOF110481-004	GWMW-33I	Groundwater	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
TA North Canton	6/10/2010	AOF110481-005	GWMW-44S	Groundwater	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
TA North Canton	6/10/2010	AOF110481-006	GWMW-44D	Groundwater	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
TA North Canton	6/10/2010	AOF110481-007	GWTB-03	Aqueous	VOCs
TA North Canton	6/9/2010	AOF110481-008	GWMW-45D	Groundwater	VOCs, Metals, Total Cyanide, Weak Acid Disociable Cyanide
<p>Note:</p> <p>TA North Canton indicates TestAmerica in North Canton, Ohio.</p> <p>VOCs indicates volatile organic compounds.</p> <p>MS/MSD indicates matrix spike/matrix spike duplicate.</p> <p>DUP indicates field duplicate.</p> <p>The sample identification utilized for the field duplicate location is listed in brackets.</p>					

Table 3. O'Brien & Gere Data validation approach using USEPA National Functional Guidelines

General Validation Approach	<p>For certain parameters, USEPA guidance for data validation indicates that professional judgment is to be utilized to identify the appropriate validation action. In these situations, the validation approach taken by O'Brien & Gere is a conservative one; qualifiers are applied to sample data to indicate both major and minor excursions. In this way, data associated with any type of excursion are identified to the data user. Major excursions will result in data being rejected, indicating that the data are considered unusable for either quantitative or qualitative purposes. Minor excursions will result in sample data being qualified as approximate that are otherwise usable for quantitative or qualitative purposes.</p> <p>Excursions are subdivided into excursions that are within the laboratory's control and those that are out of the laboratory's control. Excursions involving laboratory control sample recovery, calibration response, method blank excursions, low or high spike recovery due to inaccurate spiking solutions or poor instrument response, holding times, interpretation errors, and quantitation errors are within the control of the laboratory. Excursions resulting from matrix spike recovery, serial dilution recovery, surrogate, and internal standard performance due to matrix interference from the matrix of the samples are examples of those excursions that are not within the laboratory's control if the laboratory has followed proper method control procedures, including performing appropriate cleanup techniques, where applicable.</p>
Parameter Type	Applying Data Validation Qualifiers Approach*
Sample collection information-Cooler Temperature	Results for samples submitted for organic and inorganic analyses impacted by cooler temperatures of greater than 10°C are qualified as approximate (UJ, J).
Sample collection information-VOC Headspace	Results for sample containers submitted for VOC analysis that contain headspace are noted in the report.*
Holding times	Evaluation of organic and inorganic data for the holding time parameter is performed utilizing the method holding times from date of collection, in accordance with USEPA validation guidelines.
Calibration Data-VOCs by USEPA Method 8260B	VOC target analytes are evaluated using the criteria of 15 percent relative standard deviation (%RSD) or correlation coefficient criteria of 0.990 for initial calibration curves. Calibration verifications are evaluated using a criterion of less than or equal to 20 percent difference (%D) for continuing calibration check compounds and a %D of less than or equal to 50 for the remaining target analytes. Initial calibrations and calibration verifications are also evaluated using the response factor (RF) criteria described in the method for system performance check compounds, a criterion of greater than or equal to 0.010 for alcohols and ketones, and a criterion of 0.05 for the remaining target analytes. If analyzed, the second-source standard or low standard is evaluated using a 30% recovery or the laboratory control limits.
General Organic MS/MSD, LCS, Duplicate Data	Laboratory established control limits are used to assess duplicate, surrogate, MS/MSD, and LCS data.
	In the case that excursions are identified in more than one quality control sample of the same matrix within one sample delivery group, samples are batched according to sample preparation or analysis date and qualified accordingly.
	If percent recoveries are less than laboratory control limits but greater than ten percent, non-detected and detected results are qualified as approximate (UJ, J) to indicate minor excursions.
	If percent recoveries are greater than laboratory control limits, detected results are qualified as approximate (J) to indicate minor excursions.
	If percent recoveries are less than ten percent, detected results are qualified as approximate (J) and non-detected results are qualified as rejected (R) to indicate major excursions.
	If RPDs for MSDs or duplicates are outside of laboratory control limits, detected results are qualified as approximate (J) to indicate minor excursions.
Organic MS/MSD Data	Qualification of organic data for MS/MSD analyses is performed only when both MS and MSD percent recoveries are outside of laboratory control limits.
	Organic data are rejected (R) to indicate major excursions in the case that both MS/MSD recoveries are less than ten percent.
Sample dilution Data	Qualification of data is not performed if MS/MSD or surrogate recoveries are outside of laboratory control limits due to sample dilution.
General Inorganic MS/MSD, LCS, Duplicate Data	Laboratory established control limits are used to assess duplicate, MS/MSD, and LCS data.
	In the case that excursions are identified in more than one quality control sample of the same matrix within one sample delivery group, samples are batched according to sample preparation or analysis date and qualified accordingly.
	Qualification of inorganic data for MS/MSD analyses is performed when either MS or MSD percent recoveries are outside of laboratory control limits.
	For inorganic analyses, if RPDs for MS/MSDs, laboratory duplicates, or field duplicates are outside of

	laboratory control limits, associated detected and non-detected results are qualified as approximate (UJ, J).
	Detected sample results associated with recoveries that are greater than the laboratory control limits are qualified as approximate biased high (J ^(*)).
	Detected sample results associated with recoveries that both are greater than the laboratory control limits and less than the laboratory control limits or with one recovery outside of laboratory control limits, are qualified as approximate (J).
	Detected sample results associated with recoveries that are less than the laboratory control limits are qualified as approximate biased low (J ^(*)).
	Non-detected sample results associated with recoveries that are less than the laboratory control limits but greater than or equal to 30 percent are qualified as approximate (UJ).
	Non-detected sample results associated with recoveries that are less than 30 percent are qualified as rejected (R).
Organic MS/MSD and Field Duplicate Data	Qualification of data associated with MS/MSD or field duplicate excursions is limited to the un-spiked sample or the field duplicate pair, respectively.
Field Duplicate Data	Field duplicate data are evaluated against relative percent difference (RPD) criteria of less than 50 percent for aqueous samples and less than 100 percent for soils when results are greater than five times the QL. When sample results for field duplicate pairs are less than five times the QL, the data are evaluated using control limits of plus or minus two times the QL for soils. If RPDs for field duplicates are outside of laboratory control limits, detected and non-detected results are qualified as approximate (UJ, J) to indicate minor excursions.
Organic Blank Data	<p>If methylene chloride, acetone or 2-butanone is detected in the sample at a concentration that is less than ten times the concentration in the associated blank, the sample result is qualified as "U".</p> <p>If other target analytes are detected in the sample at a concentration that is less than five times the concentration detected in the associated blank, the sample result is qualified as "U".</p> <p>Results greater than the MDL but less than QL and within the blank action level, are replaced with the QL and qualified as non-detected (U).</p> <p>Results greater than the QL are qualified as "U" at that concentration.</p> <p>The highest concentrations of the target analytes are used to evaluate the associated samples.</p>
Internal Standard organic Data	Internal standard recoveries are evaluated using control limits of within 50% of the lower standard area and up to 100% of the upper standard area of the associated calibration verification standard. The results for target analytes associated with internal standard area recoveries 25% or greater but less than the lower standard area are qualified as approximate (J, UJ) to indicate minor internal standard recovery excursions. The non-detected results for target analytes associated with internal standard area recoveries less than 25% are rejected (R) to indicate major recovery excursions.
Serial Dilution Data	Serial dilution results are evaluated by the laboratory for data with initial sample concentrations that are greater than 50 times the instrument detection limit (IDL), in accordance with the validation guidelines. Qualifiers are applied to data that exceeded the ten percent difference based on the laboratory evaluation summary form provided.
Inorganic Blank Data	<p>When blank concentrations are less than the QL:</p> <p>Concentrations in the associated samples greater than the QL but less than five times the associated blank concentration are qualified as undetected (U).</p> <p>Concentrations in the samples below the QL are replaced with the QL and qualified as undetected (U).</p> <p>When blank concentrations are negative:</p> <p>Non-detected concentrations in the associated samples are qualified as approximate (UJ).</p> <p>When blank concentrations are greater than the QL:</p> <p>Concentrations in the associated samples of greater than the QL but less than ten times the blank concentration are rejected (R).</p> <p>No action is taken for other samples.</p> <p>If analytes are detected in equipment blanks, sample concentrations less than the QL are replaced with the QL and qualified as undetected (U). Sample concentrations greater than the QL and less than five times the equipment blank concentration are qualified as undetected (U).</p>
* Indicates that data validation guidelines do not address this situation. Therefore, validation qualifiers are not applied to data.	
Source O'Brien & Gere	

Table 4. Laboratory QA/QC analyses definitions.

QA/QC Term	Definition
Quantitation limit	The level above which numerical results may be obtained with a specified degree of confidence; the minimum concentration of an analyte in a specific matrix that can be identified and quantified above the method detection limit and within specified limits of precision and bias during routine analytical operating conditions.
Method detection limit	The minimum concentration of an analyte that undergoes preparation similar to the environmental samples and can be reported with a stated level of confidence that the analyte concentration is greater than zero.
Instrument detection limit	The lowest concentration of a metal target analyte that, when directly inputted and processed on a specific analytical instrument, produces a signal/response that is statistically distinct from the signal/response arising from equipment "noise" alone.
Gas chromatography/mass spectrometry (GC/MS) instrument performance check	Performed to verify mass resolution, identification, and to some degree, instrument sensitivity. These criteria are not sample specific; conformance is determined using standard materials.
Calibration	Compliance requirements for satisfactory instrument calibration are established to verify that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of analysis and calibration verifications document satisfactory maintenance and adjustment of the instrument on a day-to-day basis.
Relative Response Factor	A measure of the relative mass spectral response of an analyte compared to its internal standard. Relative Response Factors are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.
Relative standard deviation	The standard deviation divided by the mean; a unit-free measure of variability.
Correlation coefficient	A measure of the strength of the relationship between two variables.
Relative Percent Difference	Used to compare two values; the relative percent difference is based on the mean of the two values, and is reported as an absolute value, i.e., always expressed as a positive number or zero.
Percent Difference	Used to compare two values; the percent difference indicates both the direction and the magnitude of the comparison, i.e., the percent difference may be either negative, positive, or zero.
Percent Recovery	The act of determining whether or not the methodology measures all of the target analytes contained in a sample.
Calibration blank	Consists of acids and reagent water used to prepare metal samples for analysis. This type of blank is analyzed to evaluate whether contamination is occurring during the preparation and analysis of the sample.
Method blank	A water or soil blank that undergoes the preparation procedures applied to a sample (i.e., extraction, digestion, clean-up). These samples are analyzed to examine whether sample preparation, clean-up, and analysis techniques result in sample contamination.
Field/equipment	Collected and submitted for laboratory analysis, where appropriate. Field/equipment blanks are handled in the same manner as environmental samples. Equipment/field blanks are analyzed to assess contamination introduced during field sampling procedures.
Trip blank	Consist of samples of analyte-free water that have undergone shipment from the sampling site to the laboratory in coolers with the environmental samples submitted for volatile organic compound (VOC) analysis. Trip blanks will be analyzed for VOCs to determine if contamination has taken place during sample handling and/or shipment. Trip blanks will be utilized at a frequency of one each per cooler sent to the laboratory for VOC analysis.
Internal standards performance	Compounds not found in environmental samples which are spiked into samples and quality control samples at the time of sample preparation for organic analyses. Internal standards must meet retention time and recovery criteria specified in the analytical method. Internal standards are used as the basis for quantitation of the target analytes.
Surrogate recovery	Compounds similar in nature to the target analytes but not expected to be detected in the environmental media which are spiked into environmental samples, blanks, and quality control samples prior to sample preparation for organic analyses. Surrogates are used to evaluate analytical efficiency by measuring recovery.
Laboratory control sample Matrix spike blank analyses	Standard solutions that consist of known concentrations of the target analytes spiked into laboratory analyte-free water or sand. They are prepared or purchased from a certified manufacturer from a source independent from the calibration standards to provide an independent verification of the calibration procedure. They are prepared and analyzed following the same procedures employed for environmental sample analysis to assess method accuracy independently of sample matrix effects.
Laboratory duplicate	Two or more representative portions taken from one homogeneous sample by the analyst and analyzed in the same laboratory.
Serial dilution	Performed on a sample with a concentration minimally a factor of 50 times above the MDL in the original sample. The serial dilution (a five fold dilution) should agree within 10% of the original Original determination after correction for dilution. Otherwise a chemical or physical interference effect is suspected.
Matrix	The material of which the sample is composed or the substrate containing the analyte of interest, such as drinking water, waste water, air, soil/sediment, biological material.
Matrix Spike (MS)	Matrix spike allows for evaluation of the impact of the sample matrix (interference) on the target analytes in terms of accuracy and bias. An aliquot of a matrix (water or soil) fortified (spiked) with known quantities of specific target analytes and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery.
Matrix spike duplicate (MSD)	Matrix spike duplicate provides precision and accuracy data to evaluate the achievement of project quality objectives. A second aliquot of the same matrix as the matrix spike that is spiked in order to determine the precision of the method.
Retention time	The time a target analyte is retained on a GC column before elution. The identification of a target analyte is

Table 4. Laboratory QA/QC analyses definitions.

	dependent on a target compound's retention time falling within the specified retention time window established for that compound.
Relative retention time	The ratio of the retention time of a compound to that of a standard.
Source O'Brien & Gere	